
THE APPLICATION OF FISHBONE DIAGRAM APPROACH FOR IMPROVING THE POOR ACADEMIC PERFORMANCE IN SECONDARY SCHOOLS

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Abstract

Maintaining academic performance at school education becomes one of the important strategies in order to cope with the unparalleled competitions among schools and institutions. Poor academic performance in secondary schools in India has been called in concern, this is because it stands as the greatest reason why students' academic performance is an important quality concern. Academic performance is an important indication to what extent the students achieved the learning outcomes for subjects and programme outcomes. They are several factors which attribute to poor academic performance at secondary and senior secondary level. In order to get a comprehensive solution for academic performance, this paper addresses the implication of applying fishbone diagram strategy to school education and also identifies factors which affect academic performance. This paper reviews various causes in order to design a method for improving the academic performance.

Keywords: *Fishbone analysis, Academic Performance, Secondary school, Quality improvement, Cause root analysis*

What is Fishbone Diagram?

The Fishbone diagram is also known as the cause and effect diagram, the root cause analysis, and the Ishikawa diagram, named after its originator Kaoru Ishikawa, the Japanese quality pioneer. It is generally called the Fishbone diagram because the diagram resembles that of a fishbone. In simple terms, Fishbone is brainstorming in a structured format. The technique uses graphical means to relate the causes of a problem to the problem itself, in other words, to determine cause and effect. The diagram focuses on the causes rather than the effect. Because there may be a number of causes for a particular problem, this technique helps us to identify the root cause of the problem in a structured and uncomplicated manner. It also helps us to work on each cause prior to finding the root cause.

Cause and Effect diagram or Fishbone diagram is a graphic technique and is a good tool to find and significantly analyze affecting factors in identifying the characteristics of work output quality. This fishbone diagram is known as a cause and effect diagram. Why is it that this Ishikawa's diagram has been called "fishbone"? Well, when observed the diagram (see diagram 1), the fishbone, its form has a similarity to a fish, which has a head (as an effect) and a body in the form of bones, illustrated as causes of known problems. Root Cause is the deepest underlying cause, or causes, of positive or negative symptoms within any process that, if dissolved, would result in elimination, or substantial reduction, of the symptom.

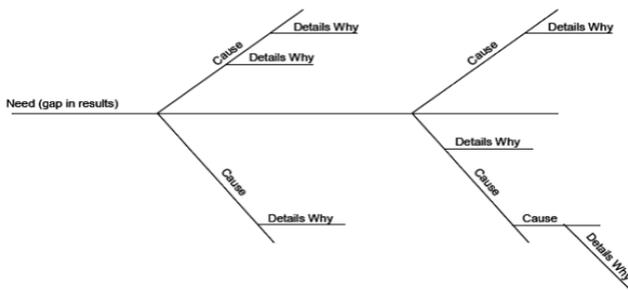


Diagram1: Model Fishbone diagram

If the root cause is deepest means, this means that we really have to dig deep to find most roots. They are usually not the most immediate, obvious or proximate causes. Some of them are three, four and five layers down into the system. School systems are social systems. They are more complex than mechanical or biological systems. This is the reason for impossible to isolate a single root cause and often it is possible to identify several causes in combination with a *symptom*. We can dissolve any one of the multiple root causes, the *symptoms* can be reduced or eliminated. Some root causes identify positive or success, negative or failure. By studying the roots for our successes, we can find strategies that can be applied to improving all our processes. While dealing problems, symptoms are found at the surface. This *symptom* gives a noticeable gap between expectation and reality. *Process* can be classified into three elements: a) input b) value-added c) output. *Dissolve*- some symptoms to dissolve with fixing a patch. Once the root is dissolved, the symptom will away of its accord. Root causes may be found at following levels: 1) Incidental or Procedural level 2) Programmatic level 3) systematic level. In schools, it may be difficult or not impossible to identify a single, specific root cause. sometimes, any one of casual factor substantially reduce or totally eliminate the problem.

Scarvada (2004) says that the fishbone diagram can be enlarged into a cause-and-effect diagram. It may be extended through a questioning technique. By identifying the causes of the effect, it is hoped that the result of the production process can be improved by changing the controlling factor of a process. This diagram is also useful for the identification of causes of a potential problem. A cause-and-effect diagram focuses on emphasizing a problem or a symptom of a problem. This diagram can also show the causes of a problem by connecting them into one group.

Fishbone diagrams are used to identify and systematically list the different root causes that can be attributed to a problem. Thus, these diagrams help to determine which of several causes has the greatest effect. The main application of these diagrams is the dispersion analysis. In dispersion analysis, each major cause is thoroughly analyzed by investigating the sub causes and their impact on quality characteristics. The Fishbone diagram helps to analyze the reasons for any variability or dispersion (Prasad et.al., 2012). Cause-and-effect fishbone diagrams focus on the problem emphasized or the symptom which becomes root causes. By identifying a real

The fishbone its form has a similarity to a fish, its head (as an effect) and a body in the form of bones are illustrated as causes or problems.(Tiann,2012). Root cause is the deepest underlying cause or causes of positive and negative symptoms. Any process if dissolved would result in elimination or reduction of the symptom.

problem and finding a root cause, an alternative action plan can be formulated or identified which in turn becomes a way out in improving the quality of education.

Why Root Cause Analysis (RCA) becomes Important?

- 1) eliminates unfounded opinion, prejudice, and organizational myth
- 2) Reduces false starts, patching of symptoms and waste of scarce resources
- 3) Converts data to information, knowledge, understanding, and wisdom
- 4) Improves data-based decision making (Preuss, 2003; City Process Management, 2008).

The advantage of Fishbone diagram is that it can break down each identified problem and everybody involved can contribute suggestions which may be the cause of the problem (Yani, 2007). The fishbone diagram is both a tool and a technique to identify a solution to a problem creatively for the improvement of educational quality. According to a research by Aroem (2013), the root cause analysis has an important role in educational innovation in deciding further corrective and innovative policies. A symptom, phenomenon, gap, or disharmony which exists in the process of education, or any actual problem arising both theoretically and practically, in macro or micro circumstances, can be analyzed by this diagram (Dahari, 2013).

Fishbone model or Root Cause Analysis (RCA) has been in use in the business world to solve problems in many areas:

- Occupational safety and health.
- Quality control in manufacturing.
- Helpful in analyzing and illustrating clinical problems.
- Evaluating supply chain and business process
- Failure analysis in engineering and maintenance.

Fishbone diagram was used in various sectors in order to structure, identify and look the big picture of the problem. Ilie and Ciocoiu (Ilie & Ciocoiu, 2010) applied the fishbone diagram for risk identification for an event in order to develop the appropriate risk treatment strategies. Dhandapani (Dhandapani, 2004) applied the fishbone diagram by combining with Pareto principles for Software industries. Behnam and Alvelos (Behnam & Alvelos, 2011) applied the fishbone diagram in tire industries in order to find the root cause that exists during retreading process. Chang and Lin (Chang & Lin, 2006) applied the fishbone diagram for the analysis of the root cause in tanker storage accident. Chow chin et al (*Chow-chin, Chun-wei, & Jon-chao*, 2008) applied the fishbone diagram in order find root cause analysis of teaching strategy to train primary pre-service science teachers. Clary, Renee, and Wandersee James, (2010) describes how can use fishbone diagram to organize read content. Reid and pat, (2014) studied categories for barriers to adoption of instructional technologies. A fishbone diagram displaying the categories and barriers within them is presented. The frameworks of categories of barriers are presented. Weiguo and Hong Lu, (2011) studied fishbone diagrams as the method of inquiry-based training and learning engineering education to develop problem-solving skills for students. They

provide an alternative theoretical foundation for rethinking and redesigning teacher practices. They find using fishbone diagram as developing problem-solving skills for students.

When Should a Fishbone Diagram used?

- 1) Need to study a problem/issue to determine the root cause?
- 2) Want to study all the possible reasons why a process is beginning to have difficulties, problems, or breakdowns?
- 3) Need to identify areas for data collection?
- 4) Want to study why a process is not performing properly or producing the desired results?

How is a Fishbone Diagram Constructed?

Basic Steps:

1. Draw the fishbone diagram...
2. List the problem/issue to be studied in the "head of the fish".
3. Label each "bone" of the "fish". The major categories typically utilized are:
4. Use an idea-generating technique (To identify the factors within each category that may be affecting the problem/issue and/or effect being studied)
5. Repeat this procedure with each factor under the category to produce sub-factors
6. Continue until you no longer get useful information as you ask.
7. Analyze the results of the fishbone after team members agree that an adequate amount of detail has been provided under each major category.
8. For those items identified as the "most likely causes", the team should reach consensus on listing those items in priority order with the first item being the most probable" cause.

In simple terms, FBD is brainstorming in a structured format (Ilie & Ciocoiu, 2010). The technique uses graphical means to relate the causes of a problem to the problem itself, in other words, to determine cause and effect. The diagram focuses on the causes rather than the effect. Because there may be a number of causes for a particular problem, this technique helps us to identify the root cause of the problem in a structured and uncomplicated manner. It also helps us to work on each cause prior to finding the root cause.

Research Problems

1. What steps should be taken to develop causes of poor academic performance?
2. Is the poor academic performance using Fishbone analysis effective and efficient?
3. Is syllabus in use for the secondary school students is inappropriate?
4. Was Supervision of schools by inspectors from the Education Department is not effectively done?
5. Is there any inadequately qualified staff in schools?
6. Is Poor teaching methods contribute to poor performance?
7. What is the students' performance for the past three years?
8. What are the types of problem that exist in the school?
9. What are the types of disciplinary problems that exist in the school?

Possible Causes for Poor Academic Achievement at Secondary School

The tasks of the team are:

- To come up with a list of as many as possible causes with the aid of FBD.
 - To reach on consensus on the most probable causes (root causes) for poor academic performance.
 - Propose methods for improving academic performance rate considering various alternatives in structuring the possible causes to address the issues related to poor academic performance.
- In diagram 2 structure for analyzing the various possible causes for academic performance

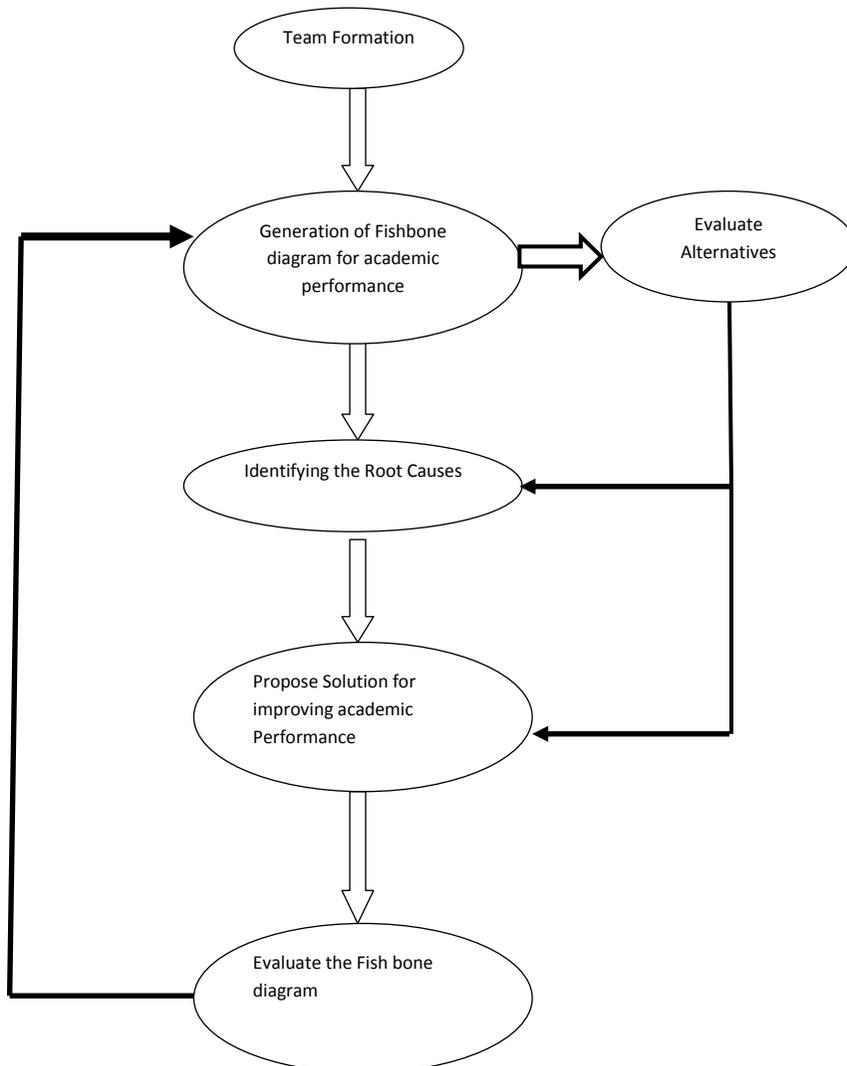


Diagram 2: Structure for analyzing the various possible causes for Academic Performance

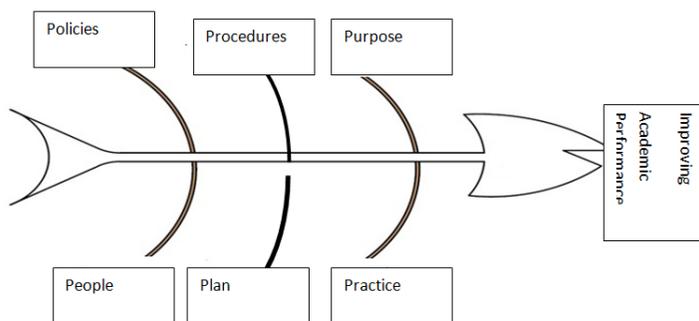


Diagram3: Categorizing the possible causes in improving Academic Performance

Identification of Most Probable Causes (Root Causes) For Poor Academic Performance

The process of finding the root causes continued by asking detailed questions about each problem causes the root cause was identified. Identification of more detailed levels of causes and organized under related causes or categories. It is observed that prioritizing the causes using Fishbone diagram model is essential in order to alleviate the issues related to Poor Academic Performance.

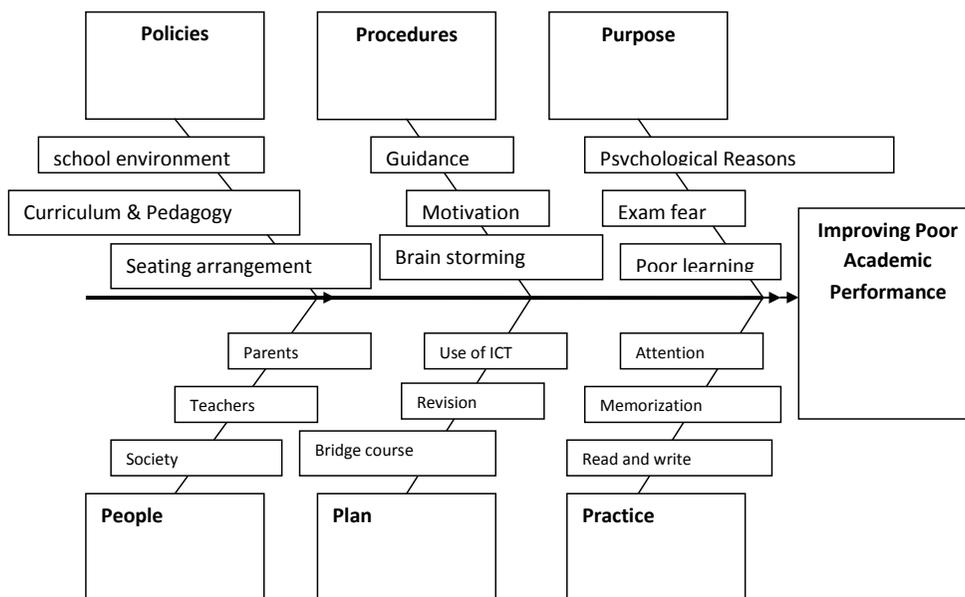


Diagram 4: Fishbone Diagram for Improving Poor academic performance

Those causes which are very related to procedures and people can be addressed first so that the effect can easily be noticed in improving the Academic performance. Some of the causes related to policy and facility can take time to implement the change of procedure and facilities like buildings might not be addressed within a short period of time.

- Medical and Psychological reasons
- Pedagogical and Curricular issues
- Exam Question patterns
- Unhealthy School Atmosphere, Environment
- School Organization
- Lack of ventilation
- Poor lighting in classroom
- Lack of safety measures
- Phobias
- Poor Attractiveness
- Difficult Contents in subjects/unit
- Inadequate time for exams
- Lack of clear plan
- Fear of failure
- Weakness enthusiasm
- Excess of pressure on student
- Parental issues/Unstable families
- Confusion/ state of tension
- Exam Anxiety
- Lack of motivation for success
- Learning disabilities
- Attention disorder

Strategic Interventions for Improving Poor Academic Performance

From people category of various causes, improving student dedication through various motivations, improving student attendance during lecture and tutorial sessions, improving student's time management skills and improving teaching-learning through different methodology can help for improving the major causes under this category. Also providing assignments, improving students with proper attention and assistance and conducting tutorials in such a way that students are involved in the discussions could minimize poor Academic performance.

- Parental Involvement Strategy
- Provision of Support Programs Strategy
- Capacity Building Strategy
- Behaviour Modification Strategy
- Provision of Life Skills Strategy
- Academic Indicators Strategy

- Family involvement in academics and learning
- Home-School Relationships
- Encouraging
- Giving memory tips
- Self-reading method
- Special guidance

Conclusions

It is possible to address the challenge posed by the distribution of student learning abilities in a class, and simultaneously improve the learning of students including those with high and low learning skills. There are several factors which attribute to improving poor academic performance at school education. Categorizing the various causes for improving academic performance with tools such as Fishbone diagram could help schools to implement continuous quality improvement. The identification of the vital few cause could help the schools to focus the resources on the causes which have a significant effect on improving academic performance. The use of collective opinion method and supporting with questionnaire data could be essential in order to come up with the accurate root causes. Identifying these factors is essential in order to design a method for improving the poor academic performance

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