Graph Theory in the Analysis of Arithmophobia

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Abstract: *In this paper, Graph theoretical concepts are applied to analyze the reasons behind Arithmophobia commonly found among the students.Bull graph is used to epitomize Mild Arithmophobia which occurs when the preparation of students to face any test is deficient.Flower graph is used to represent Intense Arithmophobia. Wheel graph is used to depict the factors which desensitize Arithmophobia. Inferring information from these types of graphs is much more easier than inferring from a self map. This analysis will help in treating Arithmophobia and improve the student's performance in Mathematics progressively. The benefits of using interactive graphical interface, graphs and graph theory metrics for a client centered analysis is also discussed.*

Keywords : P*hobia, Arithmophobia, Desensitize.*

I. INTRODUCTION

Graph theory originated ,way back in 1736 is one of the most interesting branches of Mathematics and serves as a tool to uncover the nature of physical reality .Graphs are used to model many types of relationships, physical,biological ,social and in information systems. This paper enables the graph theory application to the technique of mapping the causes for a psychological problem and use the same for the therapy. Today's generation is phobia stricken that they are unknowingly muted from moving towards success. A detailed analysis and exploration is needed to illustrate the causes of phobias in the place of self mapping. The most commonly found phobias in present   generation is Arithmophobia-(fear of numbers)which leads to phobia for Mathematics.

GRAPH THEORETICAL FORMULATION IN THE ANALYSIS OF ARITHMOPHOBIA

A. Causes of Arithmophobia:

Early Egyptians were the first to start keeping time and solar calendar when other cultures marked seasons and days based upon lunar calendars. Hindu scholar Aryabhata gave the concept of zero and further rised to the fact that numbers are infinite and never ending. This led to the myth that numbers and computation are complex, unknown, varying and also difficult to grasp. The following are the causes for Arithmophobia.

1. Genetic factors – Parent's Arithmophobia inadvertently passed to their children
2. Hallucination about complexity in Mathematics

3. Traumatic events
4. Fear of public embarrassment after low performance
5. Approach of teachers

B. Top Ten Symptoms of Arithmophobia
1. Unusual nervousness aroused soon after thinking about mathematics.
2. Dizziness
3. Excessive sweating .
4. Palpitation
5. Inability to think clearly
6. Sensational detachment from reality
7. Passive behavior
8. Unwillingness to try
9. Chest pain in very rare cases
10. A fully blown anxiety attack

C. Analytical Process Flow

A questionnaire with 12 simple questions were prepared and survey was taken from nearly 120 students.The questionnaire was prepared keeping in mind the causes of Arithmophobia mentioned above.The fact that is inferred from the survey that 98% of the students have Arithmophobia is appalling. As kids the students are interested in mathematics since it deals with only four operations (addition, subtraction, multiplication and division)and is quite different from their other theory subjects. Whereas as they grow up to learn the mathematical concepts and their applications their fear for mathematics gradually pops up. The students do not express fear when some information can be by hearted and reproduced. However the uncertainty of the solutions before solving the problems in Mathematics is the one which causes fear.

Students who are interested in mathematics at a young age start hating the subject when the teacher is not upto their satisfaction or the concept is too difficult to understand. Many students are humiliated in the class which leads to the fear of getting embarrassed in public and start hating the subject.

It is universally accepted that diagrammatic representation of a situation helps in

1. simplifying a large volume of complex data
2. quick grasping
3. revealing the hidden facts
4. inferring information for further case studies etc

So graphs can be used to compile the information gathered through the survey on Arithmophobia and utilized in treating the affected persons.

As a first step we segregate the sufferers(diffident to use the word patients) into two categories one with Mild Arithmophobia and another with Intense Arithmophobia.

D. Causes for Mild Arithmophobia

Mild Arithmophobia occurs when the preparation of students prior to assessments is not sufficient(which results in low confidence), when the person has fixed his/her goal to get a specific percentage or to score more than his/her peers. These causes for mild Arithmophobia can be expressed as a bull graph .

"The bull graph is a simple graph on 5 nodes and 5 edges whose name derives from its resemblance to a schematic illustration of a bull or ram (whose face is the triangle and horns are the graph's two bridges)".

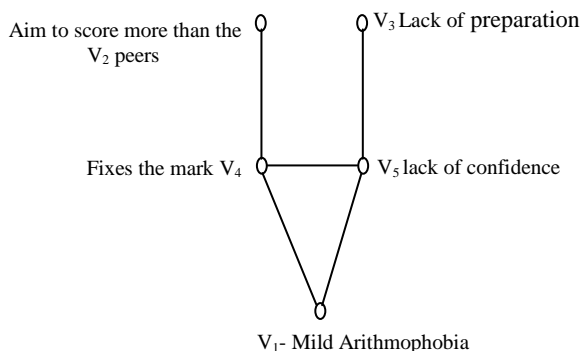**E. Directed Bull Graph Showing the Causes for Mild Arithmophobia**

Fig 1

The following table gives a clear picture of how we relate the mapping with the graph .

Table 1

MAPPING	GRAPH
Causes	Vertex
Relationship	Edge
Impact of each cause on the other in percentage	Edge line weight
Number of impacts	Degree of the vertex
Path to Arithmophobia	Path in the graph
Relationship incident on the map	Edge incident on the vertex
Cycle in the map	Cycle in the cyclic graph
Adjacent facts	Adjacent vertices

$V_1, V_2, V_3, V_4, V_5,$ are the 5 vertices of the bull graph .Vertices V_1 to V_4 represents factors which influences Arithmophobia .

V_1 _Mild Arithmophobia

V_2 – Aim to score more than the peers

V_3 – Lack of preparation

V_4 – Fixing of marks

V_5 _Lack of Confidence

In the treatment of mild Arithmophobia ,the percentage of the influencing factors can be taken as the weightage of the edges and try to remove each horn in the beginning and gradually treat the rest .Treating the horns first emphasis on the removal of the most influencing/dangerous factors and then we move on to the less influencing factors .As all of us know diagrammatic representations are the best to make a common man understand anything and leaves a long lasting impact on the minds .The benefit of using the Bull graph is to give a very clear picture of the reasons that lead to Arithmophobia.

F. Causes for Intense Arithmophobia .

Consider the root causes for Arithmophobia already discussed above. If these causes act forcefully on the sufferer then it is assumed to be intense Arithmophobia and this situation needs immediate attention .Otherwise it not only leads to low performance in Mathematics ,but low performance in other subjects too which needs computational skills. Figure 2 is a mapping which shows all the root causes of intense Arithmophobia, enabling us to prioritize and treat with ease. But the figure is quite complicated that inferring details from it becomes mind-numbing. So to make the diagram simple in figure 3, the causes are expressed as a flower graph .A flower graph **Fl***n* is the graph obtained from a helm by joining each pendant vertex to the central vertex of the helm. A person with Arithmophobia should be dealt on the basis of 2 parameters one being his/herfocus and another his/her physiology. Here a flower graph with 10 vertices are used. So it is denoted as Fl_{10} .
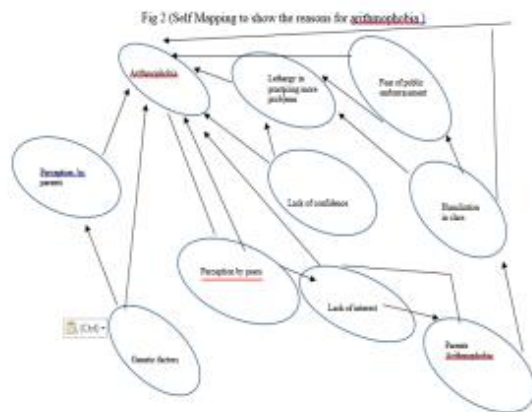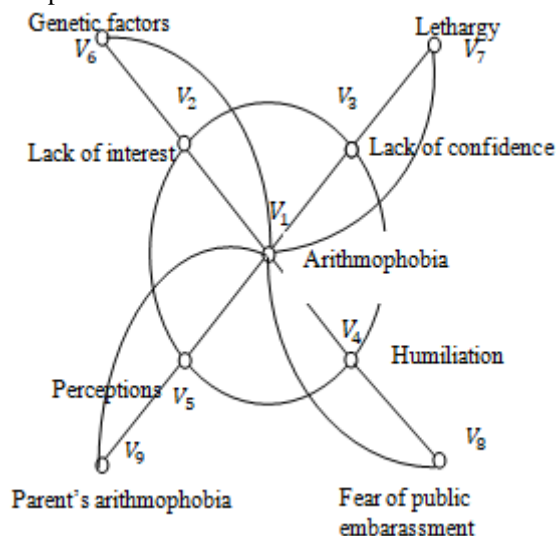

Figure 2 (Self Mapping to show the reasons for Arithmophobia)

Figure 2 depicts various factors which causes the intense Arithmophobia.It is quite obvious that the picture will not directly help in treating the sufferer because all are just clustered around the phobia without showing the weightages of each cause .So it becomes mandatory that every time we treat a cause ,we need to refer to the questioner .Whereas when we make use of the graphs in Graph theory ,it no doubt enables us to see the weightages and gives scope to treat the sufferer meticulously .Hence the flower graph is used for depicting the same .

Flower Graph showing the root causes of Intense Arithmophobia

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The table below shows the factors assigned to each vertex.

In the above flower graph ,the factors which influence the intense Arithmophobia is shown as vertices .The factors perception ,lack of interest ,lack of confidence ,humiliation is a cycle graph .The perception about mathematics by parents/peers leads to lack of interest in the subject .Lack of interest in the subject leads to lack of confidence through low performance .This lack of confidence in answering or solving

TABLE 2

VERTICES	FACTORS ASSIGNED TO THE VERTICES
V_1	Arithmophobia
V_2	Lack of interest
V_3	Lack of confidence
V_4	Humiliation
V_5	Perception
V_6	Genetic factors
V_7	Lethargy
V_8	Fear of public embarrassment
V_9	Parent's Arithmophobia

the given problems leads to humiliation in class .The student who is humiliated in class definitely passes on wrong information to his peers about learning of mathematics .Hence this can be represented as a cycle graph .By adding four more vertices to the pendant vertices V2 to V5 we develop the cycle graph to a four petaled flower graph While treating the sufferer, we try to eliminate each petal considering the weightage of the edges ,ie., the percentage of impact of each cause on the patient .Imagine we mark the weightages on each edge .Suppose the parent's Arithmophobia is the factor with high weightage and has to be treated first ,then we can call the parents and speak to them .We need to very unmistakably tell them that their fear on the subject is giving a sort of fear to their child which will evidently lead to low performance in examinations of their child not only in mathematics but mathematics related subject also. When this problem is overcome by preventing the parents from misleading, that edge is removed.So the vertex V_1 becomes pendant vertex.Gradually we make every vertex pendant vertex and the connections are removed .Finally the sufferer is free from Arithmophobia and later some mesmerizing techniques and relaxing techniques are taught .

**A.Factors which Help in Desensitizing Arithmophobia:**

The factors which help in desensitizing/cure for Arithmophobia are mentioned below and represented as a wheel graph.

"A wheel graph is a connected planar graph formed by connecting a single universal vertex to all other vertices of the graph . It is denoted by Wn".

Desensitization process is represented by W_7.

• Hypnotherapy: A hyponotherapist works on removing the symptoms of any phobia by talking to the subconscious mind of the sufferer.

• Mingling with students who are good in mathematics:
Peer learning always helps the students to learn better .
• Regular practice listening to music :
    Listening to mild music while practicising mathematics enables them to learn in a relaxed (phobia free) manner.
• Memerising techniques : Mnemonics can be used to learn difficult steps .Otherwise memorizing techniques can be followed .
• Multiformat learning techniques :
Multiple strategies in teaching enables the students to learn at their knowledge level and also enables blended learning
• Energy psychology :
This is a kind of exposure therapy ,where the therapists expose the sufferers to the situation and then heal the disturbances .

Wheel Graph Showing The Methods Of De- Sensitising The Arithmophobia
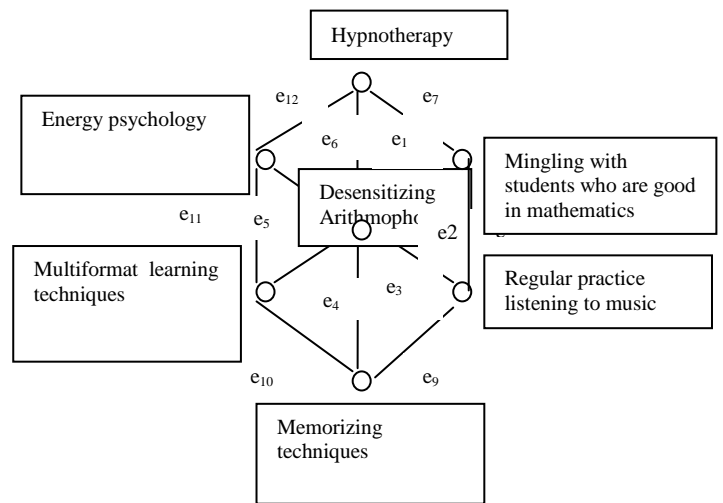
III.   CONCLUSION

To summarize,this paper focuses on an application of graph theory in the field of psychotherapy.There are a bundle of intense psychological problems faced by the youngsters. This approach is more effective and simple than the self mapping to analyse the problems faced by the sufferer.These problems unless treated at young age ,their drive to accomplish is silently hindered,When a large size sample of sufferers are analysed ,these graph theoretical techniques will be more efficient as it makes the process more simple.This leads further scope for solving the phsychological issues pertaining to the students' charter in the conventional education system.

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