Critical Factor Effect Evaluation on Integration of Discrete Mathematics Practices in Secondary Schools' Course Curriculum

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Abstract

Integration of such syllabus in the academic courses of school education which can inculcate knowledge as well as practical learning to the real world situations in students is the contemporary need of the Education System in India. So in the light of this objective the integration of discrete mathematics practices in the mathematics curriculum of the secondary school of Udaipur is under examination in the present research work. Discrete mathematics is the logically rich branch of mathematics which develops the rationale ways of thinking for the mathematical and the real life problems associated with the routine life and the academics among the students. It helps the students by allowing them to develop new and innovative practices for the complicated mathematical practices. Factors and their effect assessment on the incorporation of the new and innovative practices of discrete mathematics in the regular mathematics curriculum of secondary schools is the subject of the present research work which focuses on identifies the effect of criticalness of the factors over the incorporation. To assess the teachers' and students' perception for the factors affecting the integration of discrete mathematics in the math curriculum of the secondary school structured set of questionnaire was distributed in the schools of Udaipur district of Rajasthan.

The several statistical analysis performed over the data-set prepared from the data collected through questionnaire from the participated teachers and students it was concluded that whether the schools are old or new, large or small; CBSE or RBSE; the discrete mathematics understanding related practices levels are not dependent on them, both the types (CBSE and RBSE) of the schools tends to develop the most efficient institutional structure, level methods in their teaching skills of teachers and large and

small size schools do not differ with respect to their aggregate discrete mathematics practices, role of top management, teaching skill, mathematical aptitude, and role of books and teaching methodology improvement.

Keywords: Discrete Mathematics, Curriculum, Secondary School, Critical Factor, Perception

Introduction

Discrete mathematics topics or practices integration in the secondary level course curriculum is the contemporary need as presented by several researchers as it helps to develop the logicality and rationality in the students to understand the complex real world problems. Different types of discrete mathematics practices offers different types of learning practices and also help to develop the new axioms and set of algorithms to the teachers to make the mathematical learning more interactive and creative for the student so that they can better understand the complex mathematical practices in quite simple way. It is so because discrete mathematics practices provides prospect to a teacher to develop the pioneering strategies to understand the problem and to make decision for the problem presented to him. The set of practices and objects chosen for the study purpose in the discrete mathematics may be finite and infinite. In finite mathematics in simple terms elaborates the areas relevant to mathematics. Apart of the learning and opportunistic advantages of discrete mathematics according to the Rosenstein (1997) discrete mathematics practices are easily applicable for the objects and real world situations, easily accessible to understand the complexities, attractive to learn, and appropriate to find the new opportunities to solve the situation or the problem.

Innovative and new ways to mathematical learning is offered by discrete mathematics as learning the mathematics in a conventional way gives the impression to a student that mathematics is a set of dim-witted procedures. It is just because that the student did not find the opportunity to identify the relationship between the mathematical concepts and real world concepts meaningfully and even cannot make the students that much capable that they develop an understanding to apply the mathematic concepts into new state of affairs for deeper insight examination of the trend of the theory.

The purpose of the study is to examine the critical factors' effect on integration of discrete mathematics practices in secondary schools' course curriculum. For this secondary level schools' teachers' and students' outlook for the integration of discrete mathematics practices in the mathematics curriculum up to secondary level classes is collected through the set of questionnaire which administers the statements related to the capacity of discrete math in comparison to the conventional mathematics practices. The sample size of the study was 99 teachers of the secondary schools of Udaipur district. Feedback of sampled mathematics teachers was collected with the help of a structured questionnaire. Questionnaire was developed for the sampled mathematics teachers of secondary level schools of Udaipur district of Rajasthan to assess their opinion for the critical factors which may affect the integration of discrete mathematics practices in secondary schools' course curriculum. In the questionnaire teachers and students were asked to give their opinion for the factors related to the integration of discrete mathematics like the age

and size of the school, practices followed in continuous mathematics practices, role of top officials, role of education structure or the medium of board, teaching skill, mathematic aptitude and may more. The parameters included in the study primarily focuses on fulfilment of research objectives and development of interrelated framework of the research.

Review of Literature

Discrete mathematics practices provided prospects and opportunities to teachers to use innovative instructional and learning methods. The authors believes that discrete mathematics practices offers new and creative way of learning, new start for students and teachers to engage themselves into learning the mathematics. (De-Bellis & Rosenstein, 2004 and Wilson & Rivera-Marrero, 2004)

Discrete mathematics offers different methods and modes of learning to a student which can help a student to better understanding of the continuous mathematics in the real world situations or problems context. According to Hart (1991, 2003) teaching mathematics is quite necessary as this subject brings excitement in the classrooms, it develop problem solving capacity of a learner, mathematics can be used in business, industry, and government and mathematics complements and enriches the traditional curriculum as well.

Handal's (2003) in his study over the teachers' beliefs for the mathematic practices concluded that teachers' belief for the practices significantly affects their teaching and instructional practices. The teachers' beliefs for the integration of mathematics in course curriculum may be influenced by the pressure in the examination, availability of the supportive resources, nature and quality of the text books, students' behaviour and approach for the mathematics and supervisory style.

Llyod (2002) in his study over the impact of discrete mathematics on student and teacher concluded that a teachers' belief over the subject is must and students' love innovative practices in the class for mathematics specially those which can make them easy to understand the concepts of mathematics. Wilkins and Brand (2004) reported that teachers' opinion for the practices adopted for teaching mathematics, practices followed in continuous mathematics practices and the institutions' belief on innovative discrete math practices significantly affect the integration of mathematics in the secondary mathematics curriculum.

According to Zhihua (2011) discrete mathematics practices help to simply know form description, transforming, reasoning and proving, to master description and analysis methods of discrete system, and most importantly to be familiar with common actual discrete system model. Lifang (2011) confirmed through his study that integration of discrete mathematics pull more interest of students in learning by giving them the more understanding for the applicability of mathematics in the real world situation. Teachers should design some specific and vivid scenarios to introduce curriculum sessions to stimulate students' interest in learning.

Research Methodology and Framework

The scopes of discrete mathematics integration in the school curriculum have wide area of investigation as the factor which affects the integration of discrete math practices in the curriculum. The definitive objective of the

current research work is to assess critical factors' effect evaluation on integration of discrete mathematics practices in secondary schools' course curriculum. According to the research title and objectives qualitative research methods were adopted, as the qualitative research method and practices is good to be used in educational researches, policy analysis, factors analysis, significance analysis etc. Qualitative method of research is generally opted for those subjects who comes or starts with the question making sentences. For the present research work the primary data was collected through the help of questionnaire. The questionnaire helped to assess the participants' perception for the factors like age and size, practices followed in continuous mathematics practices, role of top officials, and role of education structure or the medium of board, teaching skill, and mathematics aptitude which may affect the integration of discrete mathematics in math curriculum of the secondary classes.

The questionnaire developed for the study was harmonized and standardized through four and five point scaling where teacher and student respondents have to give their opinion for the presented factors or statements according to their rate of agreement or observation for the factor. To ensure the quality of the questions presented in the research instrument questionnaire was forwarded to the academic experts of mathematics and education sectors of different universities of Udaipur district. The changes were incorporated in the research instrument as suggested by the experts. Keeping the research objectives in psyche that the research is focused on the certain variables (to be studied) and that should not be changed so while making the changes in the questionnaire it was under consideration that ultimate crux of the study should be sustained and properly managed under the defined objectives. The research methods used in the study is fundamentally focused on examining the interrelated variables and subjects. With some presumed opinions about the certain factors impact on the integration of discrete mathematics in math curriculum the research framework of study was deliberated.

1. Integration of Discrete mathematics influenced by the institutions capacity in terms of faculty quality, size and tenure.
2. Discrete math integration is fundamentally depends on the policy makers of the curriculum.
3. Role of the medium in which student in pursuing affect their acceptance for the discrete math integration.

A total number of 100 questionnaires were distributed to the defined sample size and the target respondents of the study were students, teachers, lecturers, and mathematicians. To target the population total 6 schools were chosen for the study purpose. The presented research work was directed under following research questions:

1. What is the perception of secondary school mathematics teachers' and students' for the factors affecting the integration of discrete mathematics practices in curriculum?
2. Does the teachers' perception shows significant difference with regard to the factors of discrete and continuous mathematics practices.

Following were the data sources from which data was observed to attain the research objectives as presented above:

1. Journals, books and magazines related to discrete mathematics and integration of maths in curriculum etc.
2. Researches and articles published in various print media.
3. Data available on internet in various websites.
4. Reports and reviews published by syllabus formation committees and councils of mathematics.
5. Questionnaire related to the teachers' and students' perception for factors affecting the integration of discrete maths practices into course curriculum.

The goal of a hypothesis is to help explain the focus and direction of the experiment. Under the conviction following research hypotheses was formulated to attain research objectives:

H_{01}: Age and size of the school is independent of the discrete mathematics understanding related practices.

H_{02}: There is no significant relationship between discrete and continuous mathematics practices with regards to their "Discrete Mathematical Practice", "Role of top officials", "Role of educational structure", "Teaching Skill", "Mathematical Aptitude", "Methodology", "Documentation" and "Student's Participation".

To examine the significance or insignificance of above stated hypotheses chi square test, T-Test and F-Test were performed. Value of Chi-Square was compared with the tabulated value of it at 5% level of significance and 1% level of significance.

Data Analysis and Interpretation

Table 1: Dependence of Discrete Mathematics Understanding Practices on Age and Size of School Institution

Null Hypothesis Ho	Calculated value of chi-square	Tabulated value		Remark
		5%	1%	
H_{01}	2.64	3.84	6.63	Not significant
H_{02}	0.238	3.84	6.63	

Source: Authors' Compilation

The chi-square values calculated in both the cases are less than tabulated value hence both the null hypotheses are not significant hence H_{01} and H_{02} cannot be rejected. It establishes the fact that the Age and Size of the organization is independent of the discrete mathematics understanding related practices. Discrete mathematics understanding related practices do not depend on age and size of the schools. Hence it can be interpreted than whether the schools are old or new, large or small; CBSE or RBSE the discrete mathematics understanding related practices levels are not dependent on them.

Table 2: Test of difference of Means between Discrete and Continuous Mathematics practices for various critical factors

Null Hypotheses	Calculated	5% Significant	1% Significant
H_{03}	2.552	Significant	Not Significant
H_{04}	2.60	Significant	Not Significant
H_{05}	1.36	Not Significant	Not Significant
H_{06}	1.937	Not Significant	Not Significant
H_{07}	1.816	Not Significant	Not Significant
H_{08}	2.389	Significant	Not Significant
H_{09}	1.743	Not Significant	Not Significant
H_{010}	2.278	Significant	Not Significant
H_{011}	2.393	Significant	Not Significant

Source: Authors' Compilation

Tabulated value: t_{28} (at 5 % level) = 2.048

t_{28} (at 1 % level) = 2.763

From the Tabulated value it is clear from the calculate results arranged in the above table and compared with tabulated value of t at 28 degrees of freedom that all hypothesis are not significant at 1% level of significance however five null hypothesis H_{03}, H_{04}, H_{08}, H_{010} and H_{011} are significant at 5% level of significance and remaining are insignificant at this level of significance.

The null hypothesis H_{03} i.e. no significant difference exist between the Old and New organizations with regards to their "discrete mathematical practices" is rejected at 5% level of significance but accepted at 1% level of significance. It establishes the fact that there is significance difference between the two types of organizations with regards to their mathematical syllabus practices. This is due to the fact that in old organizations, the mathematical teaching has been streamlined and a resistance to change has developed while in new organizations latest technology is being used. The hypothesis is accepted at 1% level of significance. This is because of the fact that both types of the organizations prefer to use latest mathematical teaching tools and practices.

The null hypothesis H_{04} i.e. there is significant difference between the Old and new organization the regards to "Role of Top Management." is rejected at 5% level of significance but accepted at 1% level of significance. This is because of the fact that in old organizations, top management plans to improve results by utilizing the existing resources in order to minimize wastage while new organizations do not face such type of problems. In the same way the null hypothesis, H_{08}, H_{010}, & H_{011} are rejected at 5% level of significance but the difference is not large enough hence accepted at 1% level of significance.

The null hypothesis H_{05} i.e. With regards to "Role of educational Structure" there is no significant difference between the old and new organizations. H_{06} i.e. No significant difference exist with regards to "Teaching Skill" between the new and old organizations. H_{07} i.e. there is no significant difference between the New and old organization with regards to "Weight age of discrete mathematics in overall syllabus." And H_{09} i.e. there is no significant difference between the New and old organizations with regards to "Role of books." are accepted at both level significance. This is because of the fact that both the types of the organization tends to develop the most efficient organizational structure, level methods are used in Teaching skills , Teaching methodology Improvement are used in skill development, documentation of discrete mathematics in overall syllabus and latest technologies are used to quality development of the maths teaching. The more advanced and sophisticated measuring instruments are being used to develop teaching methodology. These results are in agreement with the standard null hypotheses.

In order to assess that large and small organizations differs with respect to the aggregate and factor wise discrete mathematics practices, "T" test for difference of mean at 5% level of significance as well as 1% level of significance was used. The T-Test compares the means and examines that whether the difference between the mean score values is significant or not. The result of analysis is presented in table 3.

Table 3: Test of difference of Means between Large and Small organization for Discrete Mathematics Practices

Null Hypotheses	Calculated- T	5% Significant	1% Significant
H_{012}	1.997	Not Significant	Not Significant
H_{013}	0.445	Not Significant	Not Significant
H_{014}	2.136	Significant	Not Significant
H_{015}	0.828	Not Significant	Not Significant
H_{016}	0.005	Not Significant	Not Significant
H_{017}	0.873	Not Significant	Not Significant
H_{018}	0.667	Not Significant	Not Significant
H_{019}	2.813	Significant	Significant
H_{020}	2.972	Significant	Significant

Source: Authors' Compilation

Most of the above hypotheses were found insignificant at both the level of significance hence all that hypotheses were accepted. Hence, there is statistical evidence available to believe that the large and small size organizations do not differ with respect to their aggregate Discrete mathematics practices, role of top management, Teaching skill, mathematical aptitude, and role of books and Teaching methodology improvement. The possible explanation may be that computerization of techniques, use of internet and globalization of

market has minimized the gap in discrete mathematics practices of both types of educational organizations.

The hypothesis H_{014} is found significant at 5% level of significance. It supplies that role of educational structure of both the types of the organization have statistically significant difference but this difference is not found significant at1% level of difference.

The hypothesis H_{019} and H_{020} are found significant at both level of significant hence rejected. It implies that both the organization different facilities with regards to document-ation and students participation. Hence it can be interpreted that the experiences in the discrete mathematics practices make the significant difference.

To assess the impact of type of school on the adoption of discrete math practices the responding schools were categorized on in four categories i.e. english medium private schools, english medium govt schools, hindi medium private schools, hindi medium govt schools. and the factors were assessed with respect to the type of schools. To test the significance of differences which exist with regards to the factors between the large and small school and the institution, F-test using one way ANOVA was applied.

Table 4: Summarised results of F-ANOVA test

Null Hypotheses	Description	F-Value	Results	
			5%	1%
H_{021}	Discrete Mathematics practices	1.673	Not Significant	
H_{022}	Role of Top Management	1.032	Not Significant	
H_{023}	Role of educational Structure	2.042	Not Significant	
H_{024}	Teaching Skills	0.967	Not Significant	
H_{025}	Mathematical Aptitude	0.831	Not Significant	
H_{026}	Role of books	1.662	Not Significant	
H_{027}	Teaching Methodology improvement	2.331	Not Significant	
H_{028}	Documentation	1.069	Not Significant	
H_{029}	Students participation	0.674	Not Significant	

All the above hypotheses H_{021}, H_{022}, H023, H_{024}, H_{025}, H_{026}, H_{027}, H_{028} and H_{029} were found insignificant hence accepted. It established the fact that the types of school do not differ among themselves for aggregated and factor wise Discrete Mathematics Practices.

The test results reveal that the different factors (Discrete Mathematics practices, Role of Top Management, Role of educational Structure, Teaching Skills, Mathematical Aptitude, and Role of books, Teaching Methodology improvement, Documentation and Students participation) have no influence on Discrete Mathematics Practices of the responding schools. This is because the facts that the design of these practices factors are not ended to be school specific.

Conclusions and Remarks

From the statistical analysis performed over the data-set accumulated from the structured set of questionnaire several inferences were derived under the aegis of research framework and objectives which were confined to assess the critical factors effect on integration of discrete mathematics practices in secondary schools' course curriculum. It was observed that the size and the tenure from which school is in operation do not affect the understanding of the discrete mathematics practices among their teachers and students, whether the schools are old or new, large or small; CBSE or RBSE the discrete mathematics understanding related practices levels are not dependent on them.

Both the types (CBSE and RBSE) of the schools tends to develop the most efficient institutional structure, level methods in their teaching skills of teachers and for that advanced teaching methodology improvement are used to attain the skill development, documentation of discrete mathematics in overall syllabus and latest technologies are used to quality development of the maths teaching. The more advanced and sophisticated measuring instruments are to be used to develop teaching methodology.

It was also concluded that large and small size schools do not differ with respect to their aggregate discrete mathematics practices, role of top management, teaching skill, mathematical aptitude, and role of books and teaching methodology improvement. Both the types of organizations have different facilities with regards to documentation and students participation. Hence it can be interpreted that the experience in the discrete mathematics practices makes the significant difference.

The different factors (Discrete Mathematics practices, Role of Top Management, Role of educational Structure, Teaching Skills, Mathematical Aptitude, and Role of books, Teaching Methodology improvement, Documentation and Students participation) have no influence on discrete mathematics Practices of the responding schools. This is because the facts that the design of these practices factors are not ended to be school specific.

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