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J. Math. Comput. Sci. 2022, 12:32

<https://doi.org/10.28919/jmcs/6802>

ISSN: 1927-5307

FACTOR ANALYSIS ON ISSUES OF TEACHING AND LEARNING MATHEMATICS FOR UG LEVEL STUDENTS OF KAMRUP(M) OF ASSAM

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Abstract. Learning and teaching methods for mathematics are dependent on the knowledge level of both teachers and students while the facilities are also effective in developing the scope of high level education system in this subject. The study mainly revolves around the factors posing as issues in learning and teaching of mathematics in the Kamrup (M) areas of Assam. The primary aim of the study is to analyse these factors and eradicate or manage them properly to make the learning and teaching process of mathematics a success. The benefits of studying mathematics at the UG level along with the various scope of studying such a subject is emphasised as it promotes educational excellence while the system is responsible to achieve the goals efficiently. Positivism research philosophy has been opted by the researcher to gather accurate data and interpret them in an appropriate way. In order to gather survey data 13 colleges and approximately 3,000 students of Kamrup (M) were selected. Personal information of the respondents was kept confidential by the researcher.

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Received September 19, 2021

Keywords: factor analysis; undergraduate level mathematics.

2010 AMS Subject Classification: 97A40, 97B50, 97C70, 62H25.

1. INTRODUCTION

As the world is advancing science and technology are evolving rapidly. Mathematics forms the primary basis of science and technology. Therefore, mathematics holds great importance. The scope of such a subject is huge and every year an increasing number of students are opting for such a subject at the UG level to build a great career out of it. The study of mathematics is not easy but requires high IQ and diligence. The role of teachers in such a subject is vital to make the whole process of teaching and learning mathematics an efficient one. The given study revolves around the issue factors that impact the teaching and learning procedure of mathematics in Assam's Kamrup (M) area.

There are several factors which act as issues which hinder the process of mathematics. Firstly, the perception and attitude of UG students towards mathematics faculty, mathematical struggles, mathematical-problem solving, and so on form primary factors which impact the procedure. Further, the relationship between the teacher and students and the efficiency of the teacher also vastly impacts the mathematical teaching-learning procedure (Siaganet al. 2019). The teacher should be able to communicate well to teach the difficult concepts easily and effectively to the students. Further, a good teacher will be able to grow students' interest in the subjects and similarly, inefficient teachers will result in detached and uninterested students. Further, the intellect level of the students impacts the learning process. Many students find that the mathematics at the UG level to be tougher than expected and their attitude towards the mathematics struggles, subject, learning, and problem-solving changes which negatively impact the process (Das, 2019). There are basically four main factors which result in a strained relationship between the learning and teaching of mathematics of UG students of Assam's Kamrup (M) area. These are teaching methods, basic concept clearance, attention disorder (ADHD), and lack of touch and practice.

1.1. Aim and objectives. The primary aim of the study is to determine the factors which form the base of issues which challenge the smooth learning and teaching process of mathematics in

the Kamrup (M) district of Assam. The study is conducted not only to just closely state the issues but manage the issue factors productively to remove such obstacles in the learning and teaching process of mathematics to make it more efficient. The objective of the study are

- (1) To analyse the impact of Student's perceptions regarding mathematics faculty on the learning and teaching of mathematics at the UG level.
- (2) To evaluate the influence of Student's attitudes towards mathematic problem-solving and their struggle regarding mathematics on teaching and learning of mathematics at the UG level
- (3) To demonstrate the influence of behavioural alterations in students at UG level mathematics learning on mathematic teaching in Kamrup.

1.2. Hypothesis.

- (1) 1H0: Students' perceptions regarding mathematics faculty have no impact on the learning and teaching of mathematics at the UG level.
- (2) 1H1: Students' perceptions regarding mathematics faculty make an impact on the learning and teaching at the UG level.
- (3) 2H0: Students' attitudes towards problem-solving of mathematics and their struggle regarding mathematics have no relation to the teaching and learning of mathematics at the UG level.
- (4) 2H1: Students' attitudes towards mathematics problem solving and their struggles towards mathematics influence the learning and teaching of UG level mathematics.
- (5) 3H0: The behavioural changes in UG students do not influence the teaching-learning relationship of mathematics in Kamrup (M).
- (6) 3H1: The behavioural alterations in students at UG level mathematics learning influence the teaching of mathematics in Kamrup (M).

2. LITERATURE REVIEW

2.1. Introduction. The given section mainly searches, discusses, and evaluates the available literature related to the given topic area. This section mainly documents the various aspects

which are related to the chosen topic. An in-depth study has been initiated to understand the various factors related to the issues of learning and teaching Mathematics in Kamrup (M)'s UG level students.

2.2. Findings from past literature.

2.2.1. *Benefits of studying mathematics at the UG level.* Studying mathematics at the UG level holds great importance. Taking up mathematics can be challenging yet it provides a series of benefits. These are discussed below in detail:

2.2.2. *Magnificent for the brain.* Analytical and creative skills are widely demanded by every employer. Human brains develop crucial neural pathways while processing information (Srivastava, 2018). Therefore, mathematics plays a vital role in the development of analytical skills and the brain.

2.2.3. *Improved skill of problem-solving.* Problem-solving is possible because mathematics, as such provides clarity. Mathematicians acknowledge problem-solving as their central discipline as without issue and solving them mathematics do not exist (Verma et al. 2020). A student pursuing mathematics will tend to develop an improved problem-solving system and will learn ways applied mathematics resolves issues of the real world.

2.3. A smooth way to learning mathematics at the UG level. Mathematics is essential to understand the world and effectively build mental disciplines for the future. It also helps the students in solving the logical reasoning, creative thinking, and critical thinking of developing the mathematical ability of the person. According to Crisanet al. (2018), mathematics helps to prevent chaos and it helps a person in different types of activities in their life. The undergraduate students need to focus on the development of their learning by practicing more mathematics and developing the reasoning for their own study in the future. The students need to learn mathematics in a smooth way to build good problem-solving skills for their further future. Mathematics helps to improve the critical thinking and logical thinking skills among the students and make them grow more logical ideas to solve any kind of situation. Math is very crucial for a person's daily life as it helps them to understand different mathematical concepts and also encounter significant problems in life also. Problem-solving skill is very essential

to manage all aspects of life and also give a proper understanding of the problem (Sarala and Kavitha, 2017). It helps the students to focus on the quantity, measurement, interrelation, and combination for developing the growth of the business. The smooth concept and pattern of mathematics help the students to learn mathematics more actively and improve their knowledge of different mathematical concepts.

2.4. Literature gap. In this study, the analyst discusses the importance of learning mathematics and different levels of developing the skill for learning mathematics. Here it analyses the necessity for learning problem-solving skills and the way it improves the daily life of people. The study can discuss different issues which are affecting the learning techniques and the way students can overcome them. Besides that, it has analysed one theory to improve the reason and logical skills by improving mathematics. It can focus on different other theories which the educator needs to develop for teaching the students of the undergraduate level (Anwar and Rahmawati, 2017). However, it helps them to solve any problem more actively and help to do the work more efficiently while doing their study. Besides that, the experimenter can collect more knowledge from relevant resources to analyse the issues of learning and teaching mathematics at the undergraduate level. Further, the researcher can involve more authentic information to improve the research and make all the educators understand to reduce the learning issue of the students in solving any mathematical reasoning or logic.

2.5. Research methods.

2.5.1. Data collection, analysis and sampling. Primary data has been collected from 80 students and teachers of 13 different colleges of Kamrup (M), Assam by conducting surveys. As stated by Franzitta et al. (2020), primary data collection enables a researcher to gather valid and authentic data. The survey has been conducted by the researcher to accurately represent the large population. It is also a cost-effective and convenient data collecting process. Quantitative data analysis technique has been opted for this research to accurately reach a huge sample size. Thus, it has also helped in the process of statistical data analysis. The random sampling technique has been followed in this research to reduce the risk of errors. On the other hand, random sampling techniques helped the researcher to easily complete the research.

3. FINDINGS AND ANALYSIS

3.1. Findings. The findings and analysis includes survey data collection and its analysis through quantitative methods. The survey has been done with the university students of at least 13 colleges of Kamrup (M) region. The data is represented as follows:



FIGURE 1. **Demographics (Age and gender)**

Most of the respondents belonged to the age group of 20 to 22. 14.8% respondents belong to the age group above 22 and 42% belong to the age group of 18 to 20. Most of the participants of this research are female. 39.2% respondents were male while 53.2% respondents were female. Most of the respondents were unmarried. 60.8% respondents were unmarried while 31.6% employees were married.



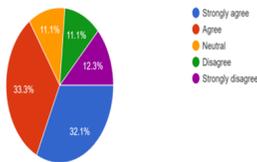
FIGURE 2. **Inappropriate teaching method and behavioural alteration**

Most of the respondents agreed that difficulty in learning mathematics in UG level students of Kamrup (M) of Assam is associated with appropriate teaching methods. 34.6% respondents agreed on the impact of appropriate teaching methods while there were 8.6% who strongly disagreed. 14.8% respondent remained neutral in this question. Most of the respondent thinks that behavioural alterations in UG students are related to the teaching methods used for mathematics. 40 1.3% respondents accepted the interrelationship between behaviour alteration and teaching

method while 10% disagreed 27.5% strongly agreed and 15% remain neutral. The teachers must have appropriate knowledge to appropriately represent the mathematical concepts. Using teaching aids for showing mathematical ideas are necessary to make the learners able to learn quickly.

Most of the respondents thought that attitudes in UG level students towards mathematics faculty impact directly on their learning style. 27.5% strongly agreed about the impact of UG level students' attitude towards mathematics faculty. There were 17.5% respondents who disagreed and 13.8% remained neutral. 38.8% responded that the attitude of the students towards mathematics faculty has a significant impact on their learning style. Most of the respondents agreed that lack of touch and practice has reduced the ability of the UG level students of Kamrup (M) to learn mathematics efficiently. 43.7 percent respondent stated that the ability of the students to learn mathematics has been reduced due to lack of touch and practice while 8.8 % respondent disagreed with this. 26.3 percent of respondents agreed the statement and 17.5% remain neutral. Most of the respondents agreed that teaching mathematics is affected by the negative attitude of

8. What is your opinion regarding that teaching mathematics is affected by the negative attitude of the UG level students?



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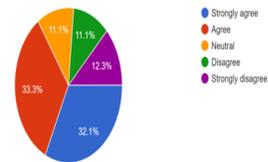


FIGURE 3. **Negative attitude of students and learner-teacher relationship**

UG level students. 33.3% respondents agreed that the teaching process can be affected by the negative attitude of the students while 11.1% strongly disagreed with this and 32.1% strongly agreed with this. 12.3% responded strongly disagreed this statement and 11.1% remained neutral. Most of the respondents agreed that the teaching learning process regarding mathematics is completely dependent on the learner teacher relationships. 39% respondent stated that there is a significant relationship between teaching learning process and learner teacher relationship

while 7% disagreed this.

A large number of respondents think that providing an appropriate structure to learn mathematics with and it can solve the teaching and learning issues. 37.2 percent agreed the importance of providing and appropriate structure to the learner is important to solve their learning issues while 5.2% disagree with this statement. A large group of respondents believe that building an effective collaborative relationship is important to improve the learning and teaching process. 31.2% respondent agreed that creating a collaborative relation is important to enhance the learning as well as teaching process. On the other hand, 13% of respondents disagree with this statement and 18.2% remain neutral. 9.1% of respondents strongly disagreed with this statement. A large group of respondents think that negative perception of failure in the student to achieve greater results in mathematics learning. 34.6% respondent agreed that the reason behind the inefficiency in learning mathematics is the negative perceptions regarding failure.

11. Do you believe that building an effective collaborative relationship is important to improve the learning and teaching process?

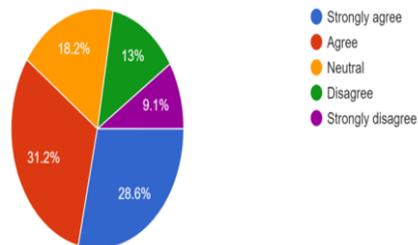


FIGURE 4. **response related to effective collaborative relationship**

23.5% respondent agreed that while 14.8% respondent disagreed that and 8.6% respondent strongly disagreed this. 18.5% respondents remain neutral in this question. As per the view of Mouzaet al. (2017), effective collaboration can help both the teachers and the learners to overcome the challenge of misconceptions. Some questions can be asked by the teachers to the students to analyse the understandings.

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.712
Bartlett's Test of Sphericity Approx. Chi-Square	118.238
df	15
Sig.	0.10

TABLE 1. **KMO TEST and BARTLETT'S TEST**

4. ANALYSIS

KMO test result 0.712, Bartlett test result 0.010.

In the above table, it has been seen that the data are suitable for the detection of the structure. The value of KMO in this case is .712 that indicates that a factor analysis can be useful for this data. On the other hand, the value of the Bartlett test is less than 0.5, which indicates that the variables are interrelated and are suitable for the detection of structure.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Vari- ance	Cumulative %	Total	% of Vari- ance	Cumulative %
1.	2.659	44.312	44.312	2.659	44.312	44.312
2.	1.185	19.747	64.060	1.185	19.747	64.060
3.	.805	13.420	77.479	*	*	*
4.	.640	10.663	88.142	*	*	*
5.	.438	7.305	95.447	*	*	*
6.	.273	4.553	100.000	*	*	*

TABLE 2. Total Variance Explained

Extraction Method: Principal Component Analysis.

5. CFA

CFA stands for Confirmatory Factor Analysis which is the specific form to analyse the factors and also used for social research. Besides that, it focuses on the measures the researcher measures to understand all the nature of the construct. It helps to analyse the hypothesis of the research and specifically focus on the number factors of the research. Here it discusses the components, initial eigenvalues and extraction of sum for the squared loadings. The total number of components is six and it analyses the percent of variance and cumulative percent of the principal components. The total for the first component is 2.659, second component is 1.185, third component is .805, fourth component is .640, fifth component is .438 and sixth component is .273. On the other hand, the percent of the variance for all the six components are 44.312, 19.747, 13.420, 10.663, 7.305, and 4.553. Those are considered as the Initial Eigenvalues. Besides that, it analyses the cumulative percent and the percentage for the all six components is 44.312, 64.060, 77.479, 88.142, 95.447 and 100.000. The extraction sums of squared loadings have two components, the total of the first component is 2.659 and second component is 1.185. In addition, the percent of variance of the squared loading is 44.312, which is the first component and 19.747 which is the second component. The cumulative percent of the extraction sums of squared loadings for the first component is 44.312 and for the second component is 64.060. The highest cumulative % is shown in the case of component 1 that is 44.312%. Total variance percentage accounted for by every factor is represented by the column % of variance. In this case the total variance is 6 as the total number of components is 6. It has also been analysed that the first five factors collectively accounted for 95.447% aggregate variance.

Total Variance Explained

Extraction Method: Principal Component Analysis.

The total number of components is ten and it analyses the percent of Initial Eigenvalues and Extraction Sums of Squared Loadings percent of the principal components. The total for the first component is 4.242, second component is 1.238, third component is 1.093, fourth component is .889, fifth component is .803, sixth component is .486, seventh .405, eighth .340, ninth .291 and

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Vari- ance	Cumulative %	Total	% of Vari- ance	Cumulative %
1.	4.242	42.419	42.419	4.242	42.419	42.419
2.	1.238	12.381	54.801	1.238	12.381	54.801
3.	1.093	10.931	65.732	1.093	10.931	65.732
4.	.889	8.891	74.622	*	*	*
5.	.803	8.030	82.653	*	*	*
6.	.486	4.864	87.517	*	*	*
7.	.405	4.049	91.566	*	*	*
8.	.340	3.404	94.971	*	*	*
9.	.291	2.907	97.878	*	*	*
10.	.212	2.122	100.000	*	*	*

TABLE 3. Total Variance Explained

tenth .212. On the other hand, the percent of the variance for all the six components are 42.419, 12.381, 10.931, 8.891, 8.030, 4.864, 4.049, 3.404, 2.907, and 2.122. Those are considered as the Initial Eigenvalues. Besides that, it analyses the cumulative percent and the percentage for the all six components is 42.419, 54.801, 65.732, 74.622, 82.653, 87.517, 91.566, 94.971, 97.878 and 100.000. The extraction sums of squared loadings have two components, the total of the first component is 4.242 and second component is 1.238 whereas third component is 1.093. In addition, the percent of variance of the squared loading is 42.419, which is the first component and 12.381 which is the second component. The cumulative percent of the extraction sums of squared loadings for the first component is 42.419 and for the second component is 54.801. The initial component number is equal to the factors taken for variable analysis. In the above table the % of variances are represented and it has been seen that this % exceeds the value of 30 in some cases. Basically, the value of 10 is a good value while the value of 20 to 30 is acceptable. The values greater than 30 are not acceptable. Thus, it has been cleared that the value of component 1 is not acceptable. The cumulative value represents the addition of each region's percentage from top to bottom of the table culminating 100%. According to this percentage the variables of this analysis are ranked appropriately. It has been seen that component 1 has the highest cumulative percentage which is 42.419%. Among the 10 components, only 3

components are retained. Initial eigenvalues are the factor variances as the conduction of factor analysis is done in the correlation matrix. However, by the standardized variables it has been cleared the variance value of each variable is 1. In this case the total variance is 10 as the total number of components is 10. It has also been analysed that the first five factors collectively accounted for 82.653% aggregate variance.

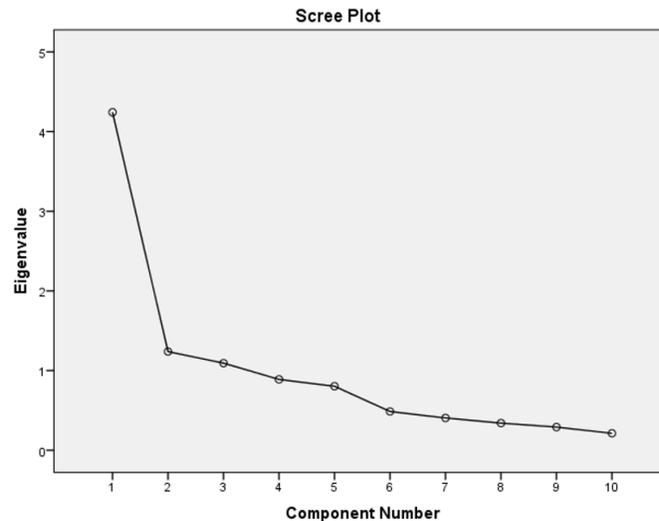


FIGURE 5. Scree plot graph

Component Matrix

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

The component loadings represented in this table are the relationship among the components and variables. Different values have been obtained to determine the relationship among the variables and components. The values range from -1 to +1 and differ from that value indicates the measurement errors in identifying correlation. Perfect negative correlation is represented by the value of -1 while a positive perfect correlation is represented by the value of 1. The above table has shown that there is positive correlation between the variables teaching methods and components 1, 2 and 3. Negative correlation has been observed between the variable collaborative relationship and components 2 and 3.

	Component		
	1	2	3
TEACHING METHODS	.568	.138	.428
ATTITUDE FACULTY	.714	.362	.171
PRACTICE EFFICIENCY	.670	.068	.064
METHOD RELATIONSHIP	.720	-.442	-.196
STRUCTURE	.814	-.203	-.122
NEGATIVE PERCEPTION FAILURE	.047	.835	-.029
COLLABORATIVE RELATIONSHIP	.794	.037	-.304
ATTITUDE STUDENT	.770	-.024	-.342
BEHAVIOURAL ALTERATIONS	.733	.134	.335
MARITAL STATUS	.132	-.360	.708

TABLE 4. Component Matrix

Rotated Component Matrix[h]

	Component		
	1	2	3
TEACHING METHODS	.208	.694	.010
ATTITUDE FACULTY	.418	.633	.309
PRACTICE EFFICIENCY	.500	.450	.065
METHOD RELATIONSHIP	.787	.149	-.332
STRUCTURE	.774	.320	-.127
NEGATIVE PERCEPTION FAILURE	-.121	.211	.801
COLLABORATIVE RELATIONSHIP	.805	.226	.158
ATTITUDE STUDENT	.818	.168	.112
BEHAVIOURAL ALTERATIONS	.394	.715	.042
MARITAL STATUS	-.194	.540	-.565

TABLE 5. Component Matrix

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 11 iterations.

Determination of the representations of the components are done by this rotated component matrix. It has been seen that the variable attitude of students is highly correlated with the component 3. However, it has also been seen that the correlation value of this variable is lower with the other components. The first component is then highly correlated with the valuable collaborative relationship. The third component is then highly correlated with the variable negative perception failure. Thus, from this test it has been cleared that this research must focus on students' attitude, collaborative relationship, and negative perception failure.

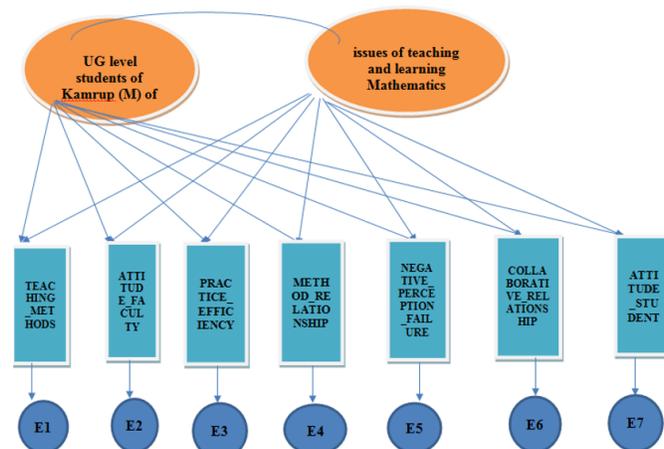


Figure 4.6: EFA model

FIGURE 6. EFA model

6. DISCUSSION

6.1. KMO TEST. The measurement related to the suitability of data for factor analysis is referred to as KMO test. Sampling adequacy is measured by this test for every variable in a model and for the entire model (Conradty and Bogner, 2018). The measurement of variance proportion among variables having common variance are the statistics. The adequacy value of this test ranges from 0.8 to 1 and the value less than 0.6 shows that inadequacy of the value and a remedial action is needed.

6.2. Bartlett test. The variance equality across categories against the alternatives are checked by this test. It also checks certain redundancies among the variables that can be summarised with few factors (Alhabeeb and Rowley, 2018). In a sample, the equal variances are called variance homogeneity. The variance analysis assumes that the equal value of the samples or groups can be obtained for the variances. This assumption is checked by this Bartlett test. The value of a particular factor analysis is expected to be useful when the Bartlett value shows a high result that is close to 1. On the other hand, if the value of the test shows less than 0.50, the factor analysis is not truly useful for the research.

6.3. CFA. The statistical technique for verifying the structure of the factor of a group of distinguished variables is referred to as CFA (“confirmatory factor analysis”). As per the view of (Ramdani, 2018), it allows the testing of hypotheses regarding relationships among the noted variables and their existing latent underlying constructs. A good RMSEA value is indicated by 0.05 and the acceptable value ranges between 0.05 to 0.08. The marginal value ranges from 0.08 to 0.1 whereas the value more than 0.1 is considered a poor value.

6.4. EFA. this measurement model is used when the latent and observed variables are expected to be calculated at the level of interval (Ong and Puteh, 2017). The structural equivalence is investigated by this EFA test. It is generally used for discovering the structure of the factors of a measure and examining the internal reliability. It is often recommended at the time of absence of hypotheses regarding underlying factor nature and measurement of their structure. The factors can be considered as an important factor for the researcher when the value of EFA will be more of 0.4. Thus, it can be stated that the accurate value could be $\lambda = +0.4$ or $\lambda = -0.4$.

6.5. Model from EFA. This model is based on the common factors and it expresses the manifest variables as common factor function, measurement errors, and unique factors (Bui et al. 2020). Each manifest variable is influenced by one unique factor. The relationship between the manifest variables is not explained in this test. The value less than 0.05 is considered as a good fit and the acceptable fit value ranges from 0.05 to 0.08. The values ranging between 0.08 to 0.10 are considered as marginal fit and the poor fit value is indicated by 0.10.

7. IMPLICATIONS AND CONCLUSION

7.1. Conclusion. Depending on the above discussion it can be concluded that the mathematical skills of the UG level students are necessary to gain the desired position in today's competitive market. The rate of innovation related to computer technology is rapidly increasing. Thus, the demand for mathematical skills of the employees is in high demand. In this research, the benefits of mathematical skills and their importance in the recent world have been discussed. In order to enhance the mathematical skills of the UG level students, an appropriate teaching structure must be developed by the teaching faculty. The methods to conduct this research have been illustrated accurately in this study. This study has shed light on the statistical analysis of the survey results.

7.2. Objective Linking. The major objective of this research was to analyse the impact of different factor such as teaching methods, basic concept clearance regarding mathematics, attention disorder, ability to represent concepts with existing knowledge on subject and method and lack of touch and practice. It has been seen in the results that the teachers and students of different colleges of Kamrup (M), Assam believe that all of these factors have a significant impact on the teaching and learning process of mathematics. It has also been analysed that the inappropriate teaching method is also responsible for the increasing rate of mathematics learning difficulties. On the other hand, the learning style of the UG level students of Kamrup (M) can be improved with an efficient mathematics faculty. Moreover, the issue related to the smooth learning and teaching process of mathematics in the Kamrup (M) district of Assam has also been identified in this study. Lack of touch and practice is a major barrier to the smooth learning and teaching process. The teaching method has also got affected by the negative attitude of the students.

8. RECOMMENDATIONS

Recommendation 1: Provide an appropriate learning structure

Recommendation 2: Building effective collaborative relationship

8.1. Research Limitations. The researcher has faced the limitation of budget constraints and time constraints. On the other hand, the study is totally based on primary quantitative data.

SMART recommendation 1			
Specific	Measurable	Achievable	Time-bound
In order to improve the mathematics among the UG level students' development of the associated skills such as critical thinking and problem-solving are necessary	Increasing interest in learning mathematics	Improvement of mathematical skills	1 year

SMART recommendation 2			
Specific	Measurable	Achievable	Time-bound
An effective collaborative relationship can be built by effectively sharing knowledge and ideas with the learners	Reduction in mathematical problem-solving difficulties	Efficiency Solving mathematical problems	2 years

Thus, there was no opportunity to gain in-depth knowledge about the variables. Moreover, at the time of formulating the objectives of this study, the focus could be increased on the variables. Due to a lack of experience, the researcher cannot improve the quality of the data collection process. This study could focus on the different strategies to improve the teaching and learning process. On the other hand, some of the journal articles that have been collected for the LR section were inappropriate, irrelevant, and printed in different languages.

9. FUTURE SCOPE

This research can identify the accurate issue associated with the learning-teaching process. Different strategies to mitigate the issues of learning difficulties can be identified. With the identification of different learning theories, the learning process of the students can be understood.

In future, the objectives of this research will focus on the variables of this study. Different learning styles will also be analysed to understand each one's effectiveness and importance. Lastly, the effect of the collaborative learning style will be analysed accurately through this research.

CONFLICT OF INTERESTS

The author(s) declare that there is no conflict of interests.

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