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InfluenceofCognitive,AffectiveandBehavioralAttitudetowardsLearningMathematicsonAchievementinMathematicsamongSecondarySchoolStudents

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Abstract:

ThisstudyFocusonInfluenceofCognitive,AffectiveandBehavioralAttitude towards Learning Mathematics on Achievement among the studentsof Government and Private Secondary Schools in Mysore District, KarnatakaState. A random sample of Four Hundred and Ninety-Five Students (N=495)Studying in IX Standard from Mysore, K R Nagara and NanjanagudutaluksofMysoreDistrict.TheDescriptiveSurveyMethodwasapplied inthepresent study. The plan adopted in thestudyisCorrelationMethod.ThetotalcontributionofalltheindependentvariablesonAchievementinMathematics of Secondary School students was found to be 77.4%, in whichthecontributionofIntrinsicmotivation(X1)=10.41%,Perceivedusefulness(X2)=14.62,Self-ConfidenceinLearningMathematics(X3)=44.57andMathematicsAnxiety(X4)=7.99%.TheSelf-ConfidenceinLearningMathematics(X3) istheFirstContributor/predictor followedbyPerceivedusefulness(X2),Intrinsicmotivation(X1)andMathematicsAnxiety(X4)onAchievementinMathematicaofSecondarySchoolstudents.

Introduction:

InIndia,mathematicsisoneofthecoremandatorysubjectstoallstudents in primaryand secondary schools.Forexample,insecondaryschoolcurricula,therearethreecoresubjects,notably,Mathematics,GeneralScienceandSocialScience.Yet,mathematicsisseenasthemostdifficult subject in many partsofthe world(Ignacio, Nieto &Barona, 2006)and India is not exceptional. Ngussa and Mbuti (2017) point out that, highfailureratesinmathematicsareduetoseveralreasonswhicheventuallydisorientstudents'learning.Thecontinuedtrendofpoorperformanceinmathematics raises concerns to the public on whether or not the educationsystem can supply graduates whopossesstheessentialskillsto enablethem to cope with the ever-evolving technological society (Hamilton, Mahera,Mateng'e&Machumu,2010).Theseresultsprovideanavenueforfurtherresearch that seeks to characterize and understand the various factors thatmay influence students' performance inmathematics.Thiswillhelptodeviseplausiblestrategiesforfutureactionsoastobringaboutanimprovementinthepassratesinmathematics.

Learningmathematicsdoesnotonlyinvolvethinkingandreasoning,itisdependentontheattitudesofthelearnerstowardslearningandmathematics (Anthony &Walshaw, 2007; Grootenboer, Lomas, & Ingram,2008; Kele& Sharma, 2014). Han and Carpenter (2014) state that attitudesconsist of cognitive, affective and behavioural reactions that individualsdisplay towards an object or the surrounding based on their feelings orinterest.

Attitude refers to a learned tendency of a person to respond positivelyor negatively towards an object, situation, a concept, or a person. It is alsoregardedasabeliefheldbyindividualsthatreflectstheir opinionsandfeelingsandcanbesometimesmanifestedinbehaviour(Joseph,2013) .Attitudes,behaviour,andfeelingsareinterrelatedinsuchawaythatpeople'sattitudesdeterminetheirbehaviourtowardsobjects,situations,and

people.Theyalsoinfluencetherelationshipsthatexistamongthesevariableswithth emselves(Joseph,2013).

Attitude is a hypothetical construct that cannot be observed directly,but can be inferred from measurable reactions to the attitude object (Ajzen,1993), as it is the case in our study, learning math. In accordance withSyyeda (2016), attitude is multidimensional. It takes into account

threecomponents:affect,cognition,andbehaviour.Affectiscomposedofemotio ns, beliefs, and vision of the subject. Emotions are the feelings ofenjoymentorpleasureinlearningthesubjectorseeingitasboring,difficult,an ddull.Beliefsare relatedtostudents'confidenceintheirabilitiestolearnthe subject. Vision represents students' perception regarding mathematics.Cognitionrepresentsthestudents'perceivedusefulnessofthesu bject.Conversely, behaviour is connected to students' motivation to learn that isreflectedwithstudent'sactions, commitment,andperformanceinclass.

Using these components to understand the students' attitude towardsmathematics,wemeasurethefollowingaspects:

– **Self-Confidence,Anxiety,Enjoyment(Affect)**

– **IntrinsicMotivation(Behaviour)**

– **PerceivedUsefulness(Cognition)**

Researchershave concludedthat students' attitudes play a vital roleinthelearningofmathematics(Ingram,2015;Kele&Sharma,2014)However,o nlyafewstudieshaveinvestigatedtheeffectsofteachingmathematicsinasportingc ontextonstudents'attitudestowardslearningmathematics.Mostoftheresearchin vestigatedtheeffectsofsportsonacademicoutcomes(Robinson,2012).Thepurpos eofthisstudywastoinvestigateifteachinginasportingcontextwouldhaveanimpact onstudents' attitudes towards learning mathematics. The data reported in thispapercomesfromalargerstudy(Sanchal,2016).

This study aimsat exploring the attitude of students toward mathematicsingeneralandanalyzesstudentattitudedifferencebydemographicso fstudentsinsecondaryschools.Theresultsofthisstudywillrevealthe

effect, if any, of the initial and exiting attitude toward mathematics.Thus, itwillcontributetothecurrentknowledgeregardingstudents'attitude,learning and achievement concerning mathematics at school level and revealthe ways of creating positive attitude towards mathematics. Moreover, it willbe useful for school teachers of mathematics for planning their lessons withdifferentiable learning approaches and strategies. Creating positive attitudestowardsmathematicsinstudentsisoneoftheimportantgoalsofthisresearch.Italsohelpstoimplementinnovativemethodsinteachingmathematicsandfindouttheconditionofprofessionaldevelopmentofschool level mathematics teachers and the implications of the results of thestudy.

SIGNIFICANCE/RATIONALEOFTHESTUDY:

Thestudyisalsoexpectedtocontributetotheadvancementofknowledgeaboutthefactorsaffectingperformanceofmathematicsamongsecondary school students. The study would also have practical significancebecauseitwouldleadtotheimprovementofstrategiesaimedatimprovingtheperformanceinmathematicsbyfosteringstudents'attitudeinmathematics in secondary schools. The study would be of immediate help tocurriculumimplementersintheformulationofstrategiesaimedatenhancing students' attitude in mathematics. The study formsabaseonwhichotherswoulddeveloptheirstudies.

Thisispreciselythereasonwhythepresentstudyisundertaken.

- This Study will provide some insights about the relationship betweenAssociatedfactorsofattitudetowardslearningmathematicswithAcademicAchievementinMathematicsofthesecondarySchoolstudents.
- The results of the study will have far- reaching consequences as theyareveryhelpfulforteachersingeneralandguidance/educationalcounselorsinparticular.

- The results of the study will also enable them to know the factors thataffecttheiracademicachievementinMathematicsorhelptheAcademicAchievementofstudents.

- Therecommendationsofthestudymaybehelpfultothepolicymakersinthedirectionofevolvingnewpolicies,thiswouldassisteducation plannersand curriculum developers to map out strategiesbywhichperformancecanbeimproved

- The study would be of immediate help to curriculum implementers inthe formulation of strategies aimed at enhancing students' attitude inmathematics. The study forms a base on which others would developtheirstudies.

Even though there are many factors which may influence an individual'sacademic achievement, in this study it is decided to find out relationship offourfactors,namelySelf-ConfidencetowardsLearningMathematics,MathematicsAnxiety,IntrinsicmotivationandPerceivedusefulnessofstudentsofSecondarySchoolswiththeirAchievementinMathematics.

SCOPE/DELIMITATIONOFTHESTUDY:

ThisstudycentersonrelationshipbetweenAchievementinMathematicswithSelf-ConfidencetowardsLearningMathematics,MathematicsAnxiety,IntrinsicmotivationandPerceivedusefulnessofthestudents ofGovernment andPrivateSecondary Schoolsin MysoreDistrict,KarnatakaState.ItisaimedatallGovernmentandPrivateSecondaryschools' students in Karnataka State,but due totime,moneyandotherfactors study was limited to only Twenty Four Secondary schools in MysoreDistrict. The contentscope covered Cognition, Affect and Behavioral Aspectsof Attitude towards Learning Mathematics such as Self-Confidence towardsLearningMathematics,MathematicsAnxiety,IntrinsicmotivationandPerceived usefulness which Correlates/affect Achievement in Mathematics ofIXStandardStudentsinMysoreDistrict.

STATEMENTOFTHEPROBLEM:

Thestatementoftheproblemofthepresentsurveyis,"InfluenceofCognitive, Affectiveand Behavioral Attitudetowards Learning MathematicsonAchievementinMathematicsamongSecondarySchoolStudents"

VARIABLES:

- AchievementinMathematics
- Self-ConfidenceinLearningMathematics**(Affective)**
- MathematicsAnxiety**(Affective)**
- IntrinsicMotivation**(Behavioral)**
- PerceivedUsefulness**(Cognitive)**

OBJECTIVEOFTHESTUDY:

- TostudytheSignificantcontributionofpredictorvariables(Self-ConfidenceinLearningMathematics,MathematicsAnxiety,Intrinsicmotivation, Perceived usefulness) in predicating the criterion variable(AchievementinMathematics)ofSecondarySchoolStudents.

HYPOTHESES:

- ThereisnoSignificantdifferenceinthecontributionofpredictorvariables(Self-ConfidenceinLearningMathematics,MathematicsAnxiety, Intrinsic motivation, Perceived usefulness) in predicating thecriterion variable (Achievement in Mathematics) of Secondary SchoolStudents.

RESEARCHMETHODOLOGY:

The study employs descriptive research of survey type, toinvestigatetheAssociatedfactorswithattitudeofstudentstowardstheLearning MathematicsinSecondarySchoolsonAchievementinMathematicsin

MysoreDistrictofKarnatakaState.TheDescriptiveSurveyMethodwasapplied in the present study. It identifies the current status of the researchstudy. The plan adopted in the study is Correlation Method. The plan didnotentailanyexperimentorthemanipulationofanyindependentvariable.

POPULATIONOFTHESTUDY:

The students studying in various secondary schools in the academic year 2022–2023of standard IX in Mysuru District were considered as a population of this study. According tothe Department of Public Instruction of Karnataka, there are altogether 270558 Students wereStudyingin768SecondarySchoolsinSevenTaluksofMysuruDistrict.Outof768Secondary Schools,231schoolsarerunbyDepartmentofEducation,134schoolsarerunbyAided

Management, 348 schools are run by private Management, 46 schools are run bySocialWelfareDepartmentand8schoolsunderbyCentralGovernment.46686StudentsareStudying in IX Standard out of 270558 student population. Researcher Selected Randomlythreetaluksoutofsevenforconductingresearchnamely,Mysore,KRNagaraandNanja nagudutaluks.

SAMPLING:

InthepresentstudyRandomSamplingTechniquewasadoptedbytheresearcher . The Sample for the present study consists of the students of IXstandardstudyinginSecondarySchoolsinMysoreDistrict.

SelectionofSchoolsandStudents:

A random sample of Four Hundred and Ninety-Five Students (N=495)Studying in IX Standard from Mysore, K R Nagara and NanjanagudutaluksofMysoreDistrict.Researcherwasselected202studentsfrom 9GovernmentSecondarySchools,129studentsfrom6AidedSecondarySchoolsan d164studentsfrom9PrivateSchools RandomlyinMysoreDistrict.outof495students202wereboysand292weregirls.

TOOLSUSEDFORTHESTUDY:

Investigator constructs his own tools for Achievement in Mathematics, Attitude towardsLearning Mathematics such as Self-Confidence in Learning Mathematics, Mathematics Anxiety,Intrinsic Motivation, Perceived usefulness; the investigator made a careful selection of theavailable standardized tools which could be validly applied to the sample of students selectedfor study. All the tools selected were those that were developed for the use with pupils ofsecondary classes. Care was taken to assure that the tools had accepted levels of validity andreliability.

DATACOLLECTIONPROCESS

The study was planned to be conducted with a total of 495 ninth-grade students in 24Secondary schools of in the Mysore District of Karnataka State at the end of 2022-2023 Academicyear. Student engagement in the research was voluntary. Permission was granted from the

DeputyDirectorofpublicInstructioninordertoconductthestudy.Laterresearcherconductedthedata

collectionprocessesandvisitedallthe24 schools anddistributedtheall thetoolsto

thestudentsineachschool.Afterreceivingthefilledtoolsanswers,someoftheformswereeliminatedbecause

someofthestudentswhoparticipatedinthestudyleftsomeitemsblankwhilefillingouttheforms,and some of the students' answers were found to be inconsistent during the control of the tools.Followingtheelimination,atotalof 495studentformswerefoundtobevalid.

STATISTICALTECHNIQUES:

Thehypothesesmaybetestedbyanalyzingdatabyapplyingappropriatedescriptiveandinferentialstatistics.

- **Co-efficientof Correlation:**This statisticaltechniqueisemployedtoverify hypotheses pertaining to correlation studies. It is used to estimatethesignificanceoftherelationshipbetweenthetwovariables.
- **Regression:**Astatisticalprocedureinwhichmorethanonepredictorvariable is correlated with a target variable as well as with the other

predictorvariablesinordertoformalinearmodelusingaweightedsumofthepre dictorvariablestopredictvaluesofthetargetvariable.

AnalysisandInterpretationoftheData:

Table1:Regressionco-efficientofsecondaryschoolstudents(ModelSummary)

R	R Square	Adjusted RSquare	Std. Error of theEstimate	F-Value	Sig.
0.881a	0.776	0.774	4.04357	424.308	0.000

ThecoefficientofmultipledeterminationofR^{2}is0.774.Itcanbetherefore,bes aidthatnearly77.4percentofthevariationinAchievementinMathematicsofsec ondaryschoolstudentsaccountedforwhateverismeasuredbyIntrinsicmotivat ion(X1),Perceivedusefulness(X2),Self-ConfidenceinLearningMathematics(X3)andMathematicsAnxiety(X4)takent ogether.TheSEestfortheregressionequationis4.04357.Thismeans that each time the regression equation for the sample is used topredictaAcademicAchievement;thechancesarepredictedAchievementinM athematics will not miss the actual Academic Achievement of secondaryschoolstudentsbymorethan±4.04357.

TheeffectofIntrinsicmotivation(X1),Perceivedusefulness(X2)Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4), wasfound to be significant (F=424.308, p<0.01) on Achievement in MathematicsofSecondarySchoolstudentsat0.01levelofsignificance.Hence,thenu llhypothesis is rejected and alternative hypothesis is accepted. It means that,Intrinsicmotivation(X1),Perceivedusefulness(X2),Self-ConfidenceinLearning Mathematics (X3) and Mathematics Anxiety(X4) are the significantPredictorsofAchievementinMathematicsofsecondaryschoolStudents .

Table3:MultiplelinearregressionsSchoolEnvironment,Anxiety,AdjustmentandS tudyHabitsonAcademicAchievementofsecondaryschoolstudents

Model	UnstandardizedCoefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	-1.097	2.323		-0.472	0.637
Intrinsicmotivation(X_1),	0.093	0.016	0.163	5.991	0.000
Perceivedusefulness(X_2)	0.147	0.021	0.207	7.018	0.000
Self-Confidence inLearningMathematics(X_3)	0.284	0.017	0.533	16.769	0.000
Mathematics Anxiety(X_4)	-0.071	0.014	-0.136	-5.193	0.000

Fromtheresultsofabovetable3,weobservedthatthefollowings:

TheeffectofIntrinsicmotivation(X1),Perceivedusefulness(X2)Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4) wasfound to be significant on Achievement in Mathematica of secondary schoolstudents at 0.01 level of significance. Hence, the nullhypothesisis rejectedandalternativehypothesisisaccepted.Itmeansthat,Intrinsicmotivation(X1),Perceivedusefulness(X2),Self-ConfidenceinLearningMathematics (X3) and Mathematics Anxiety(X4) are significant predictors ofAchievementinMathematicsofsecondaryschoolstudents.

TherelativecontributionofIntrinsicmotivation(X1),Perceivedusefulness(X2) Self-ConfidenceinLearningMathematics(X3)andMathematicsAnxiety(X4)onAchievementinMathematicsofsecondaryschoolstudentsarepresentedinthefollowingtable.

Table 4: Relative contributions of predictor variables on criterion variable(AcademicAchievement)ofsecondaryschoolstudents.

IndependentVariable	β	r	β x r	%ofcontribution
Intrinsicmotivation(X_1),	0.163	0.441	0.104143	10.41427
Perceivedusefulness(X_2)	0.207	0.674	0.146157	14.61569
Self-Confidence inLearningMathematics(X_3)	0.533	0.748	0.445685	44.56851
MathematicsAnxiety(X_4)	-0.136	-0.531	0.079876	7.987642
Total			0.774	77.4%

The total contribution of all the independent variables on Achievementin Mathematics of Secondary School students was found tobe77.4%,inwhichthecontributionofIntrinsicmotivation(X1)=10.41%,Perceivedusefulness(X2)=14.62,Self-ConfidenceinLearningMathematics(X3)=44.57and Mathematics Anxiety(X4)=7.99%. Therefore we conclude that, The Self-Confidence in Learning Mathematics (X3) is the First Contributor/predictorfollowedbyPerceivedusefulness(X2),Intrinsicmotivation (X1)andMathematicsAnxiety(X4)onAchievementinMathematicaofSecondarySchoolstudents.

Theregressionequationdevelopedforthecontributionofpredictorvariables (Intrinsic motivation(X1), Perceived usefulness(X2), Self-Confidencein Learning Mathematics (X3) and Mathematics Anxiety(X4)) in predicatingthecriterionvariable(AchievementinMathematics)amongSecondary SchoolStudents(N=495).

i.e.,Y=-1.097+0.163(X1)+0.207(X2)+0.533(X3)-0.136(X4)

Major Findingsofthe Study:

- Intrinsic motivation(X1), Perceived usefulness(X2), Self-Confidence inLearningMathematics(X3)andMathematicsAnxiety(X4)arethesignificant Predictors of Achievement in Mathematics of secondary schoolStudents.

- The total contribution of all the independent variables on Achievement inMathematicsofSecondarySchoolstudentswasfoundtobe 77.4%,inwhichthecontributionofIntrinsicmotivation(X1)=10.41%,Perceivedusefulness(X2)=14.62,Self-ConfidenceinLearningMathematics(X3)=44.57 and Mathematics Anxiety(X4)=7.99%. Therefore, we concludethat,TheSelf-ConfidenceinLearningMathematics(X3)istheFirstContributor/predictorfollowedbyPerceivedusefulness(X2),Intrinsicmotivation(X1)andMathematicsAnxiety(X4)onAchievementinMathematicaofSecondarySchoolstudents.

- Theregressionequationdevelopedforthecontributionofpredictorvariables(Intrinsicmotivation(X1),Perceivedusefulness(X2),Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4))in predicating the criterion variable (Achievement in Mathematics) amongSecondarySchoolStudents(N=495).
  i.e.,$Y = -1.097 + 0.163(X1) + 0.207(X2) + 0.533(X3) - 0.136(X4)$

CONCLUSION:

In light of the research's findings, we may suggest some recommendations to helpsecondary school students boost their confidence in learning mathematics, decrease theirarithmetic anxiety to a tolerable level, and make sure they take a positive attitude on mathlessons. Rather than only learning how to solve problems, students should have the chance toembracetheproblem-solvingprocess.Byusinginnovativeteachingandlearningtechniques

thatwillinterestthestudents'interestinstudyingmathconceptsandtheories,teacherscanassistthel

earnersindevelopingtheirhighself-

confidencetoperforminmathematics.Parentscanencourageandhelptheirchildrenastheystruggle

withmath,which willinspireparentsto learn more about the reasons behind their children'

unfavourableviews

towardsmath.Themathematicsprogramofaschoolmaybeimprovedthroughplansputforthbytheadm

inistrationthatarespecifictotheinterests,andissuesofthestudents.Thismightberequiredtoencourage

studentstoreachhigherlevelsofeffortandmotivation,whichcouldleadtobetter mathperformance.

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