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INHERENT CORRELATION BETWEEN MATHEMATICAL INTELLIGENCE, REACTION TOWARDCALCULUS, TEACHING COMPETENCE AND CALCULUSLEARNING OUTCOME

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ABSTRACT

This article means to unveil elaboration of mathematical intelligence and reaction or attitude toward calculus and teaching competence has an inherent impact toward calculus learning outcome. This researchtook place of 176 students as respondents with simple random samples of Faculty of Mathematics and Natural Science of Medan State University. The research analysis carried out bycorrelative coefficient and simple and multiple regression. The findings disclosed a positive correlation into (1) mathematical intelligence (X_1) turns correlative coefficient and partial correlation if controlled reaction or attitude toward calculus (X_2) and partial correlative coefficient controlled teaching competency (X_3) and partial correlative coefficient with controlled reaction or attitude toward calculus (X_2) and teaching competency (X_3) all of them are significant and then determinant coefficient is $R_{y1.23}$ = 0.24or 24% pure contribution mathematical intelligence (X_1) toward calculus learning outcome (Y) (2) reaction or attitude toward calculus (X_2) spawns correlative coefficient and partial correlation if controlled mathematical intelligence (X_1) and partial correlative coefficient teaching competence (X_3) are all significant and multiple regression $r_{y2.13}$=0,51. $R_{y2.13}$ = 0.26 or 26% pure contribution on attitude toward calculus (X_2) on calculus learning outcome (Y) (3) teaching competence (X_3) sparks correlative coefficient and partial correlation if controlled mathematical intelligence (X_1) and reaction or attitude toward calculus (X_2) are all significant and its determinant coefficient R_{y3} = 0.54 or 54% its teaching competence (X_3) contribution toward calculus learning outcome (Y). Coefficient multiple correlation is $r_{y.123}$ =0.86, $R_{y.123}$ = 0.74or 74% aggregate contribution of mathematical intelligence (X_1), attitude toward calculus (X_2), teaching competence (X_3) toward calculus learning outcome (Y). Therefore, institutional or educational practitioner by this research result strongly to advocate that teaching competence (X_3) as a culmination issue must have focused priority among these three variables observed within Natural Science and Mathematics Faculty of Medan State University, Indonesia in particular.

Key words: Mathematical Intelligence, Reaction or Attitude Toward Calculus, Teaching Competence and Calculus Learning Outcome.

INTRODUCTION

Educational enhanced quality becomes perpetual issues that requisitely most concerned to persuade either conventionally or innovatively moving on. A forethought to bring it up coincided after looking into calculus learning outcomes. One of the most focused by this terms is calculus course that which regarded crucially a prerequisite requirement subject, particularly in faculty of mathematics and natural science. Calculus is practically effecting of solving problem into society lives. It's learning outcome gleaned by interactive stimulus and responsiveness, these two factors are provoked to rekindle students' proactive promptness and motivation. Learning outcome is defined also learning process attainment within a certain of period gauged by internal or external factors of personal conditions by which internal factors impressed by: physic, interest, talent, motivation, behavior, educational background, intelligence, etc., whereas external factors which considered an impediment affected by lecturer's performance, academic facility. Therefore some questions might arise concerning of unsatisfied calculus learning outcome: (1) what factors do impact to low potential learning calculus?, (2) is it simply caused by pre-debilitative aptitude at mathematics?, (3) is it haunted by unqualified teaching?, (4) how good a lecturer at calculus is?, (5) how well lecturer's prowessor skills to implement calculus is about?, (6) how's lecturer's competence to impart the presentation?, (7) how smartlecturer to excite with proactive asks and questions is?, (8) how innovative a lecturer to promulgate learning motivation is?, (9) how capable a lecturer to imbue a partaking learning process is?, (10) how earnest a lecturer to evaluate learning outcome is?, (11) how intense interrelationship fostered between lecturer and students is about. (12) how veracious a lecturer to keep up bearing professionalism is. Encountered another questions in respect tostudents' preconception of learning calculus: (1) how fervent of students to be good at calculus is?, (2) what do students perceive about learning calculus?, (3) how vast they might vibrate calculus infiltrating into real lives?, (4) do students view about calculus is a formidable subject?. (5) what is the best latter expectation about after learning calculus to offer?.

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To sum up all above questions hereby to represent with three consolidated inquiries: (1) how competent of a lecturer at calculus teaching is?, (2) how intense of students' ventures to become well at calculus is?, (3) how significant of students' mathematical intelligence to impact to learning calculus is?.

THEORITICAL STUDY

All students have unique learning styles. Students gain strong benefits when their teachers and Learning Coaches recognize their strengths and weaknesses as learners. Howard Gardner, a psychologist and professor of neuroscience at Harvard, developed one theory in 1983. Gardner defines "intelligence" not as an IQ but, rather, as the skills that enable anyone to gain new knowledge and solve problems.(Tracy Oswald, 2015)

"Why Should Anyone Study Mathematics and Honor Calculus?"

Everyone should master basic mathematics, at least algebra, and helps students to understand the world around them, and needed to for problem-solving and analysis. Calculus should be required to all college students and should be set by the teacher. Mathematics or calculus is the language of nature, should be taught with more underlying theory and with more applications. Learning mathematics or calculus makes more intelligent, can save money, can keep society going on, and invent new things, teaches discipline. (Anonymous, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7) The sort of math that is needed for a person to be competent in our society is not very complex. A person should be able to do the basic addition, subtraction, division, and multiplication. They need this to be able to handle money, prepare food, and to do simple calculations that are present in all job types. (Math's Use in Society-Joey Harp, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7).

The study of mathematics is extremely important for many reasons. Most importantly, math surrounds us in many aspects of our everyday life. Our monetary system, system of measurement, mechanical objects such as automobiles and many other aspects of life we encounter daily are highly dependent upon math. If an individual is unable to perform simple mathematical processes, he or she finds himself in a highly disadvantaged situation that lacks a certain understanding of how things operate. These individuals lack beneficial abilities such as pattern recognition and logical reasoning that are developed in mathematical instruction. Math is typically a subject associated with geniuses such as Einstein and other so-called "nerds." Maybe it is the media's fault for associating math with such an image, but I think that this image of such difficulty makes some students feel inferior from the get-go and that they will be unable to succeed in math regardless of what they do. This results in a lack of effort to comprehend the material. I feel that removing math education requirements would be greatly detrimental to our society, and that the nagging about math's difficulty would only be replaced by another subject.

It may be required that our society place a stronger focus on mathematics earlier on in the education process to correct this problem. If students are quickly taught that math is important and are correctly taught the basics of the subject, they will be able to succeed with more ease when they reach the collegiate level. I feel that more practical application of math may spark the interest of students, and therefore should be incorporated into the curriculum. (Mike Leovic, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7).

"The great book of nature can be read only by those how know the language in which it was written. And that language is mathematics. (Galileo)".It is also important to study mathematics because it gives one a different perspective on things. Learning math involves a different type of thinking that is not addressed in other subjects. To be a well educated person one need to be able to think methodically and analytically as well as figuratively. People most commonly state that math is hard and they will never need to use math in their majors. (David Neroni, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7).

That and the fact that Calculus with Business Applications teaches math and applies it to business problems makes it illogical to argue that math has nothing to do with business and other related majors. (Anthony Paulin, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7). The study and application of mathematics has led to the invention of almost everything we see and use today. The building we live, work, and play in are constructed to specifications based on mathematics. The currency we use is a form of mathematics. Without mathematics our lives would be very different.

The inventors, and mathematicians are the people that created these things, and most people do not know how, or care how, they work. Math in the American society is seen as useless if you are not going into a profession that uses it. Why should an English major, who wants to write books, be required to learn math? And in being required what level should he or she have to learn?. There is a difference on the other hand, in whether math should be required in high school and college. High schools that are teaching college preparatory courses should be required to teach enough math to be able to pass standardized tests to get into college, and for use in basic life skills. Higher levels of math should be encouraged but not required. Dealing with the college education, some math is required just to be able to survive adequately in society. If a college had general education credits because they want their students to be well rounded than math is a necessity. If there is no general education then depending on the major math should be required.

In order to graduate from a university a student must have more knowledge than those who have not been to college. (anonymous, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7). In *The Republic*, Plato presents a better argument for why math should be required for all high school and college students. He argues that math and geometry teach problem-solving skills and how to analyze and think. In other words, math is necessary for understanding, whether it be in engineering or philosophy (Plato, p. 184). Basically, he is saying that in order to understand and learn any subject, you need to have some basic math skills. Based on this, I recommend that math be required for college and high school students. The next question that arises is that to what level should the math requirements go up to? I argue that everyone should be at least required to take math up to and including pre-calculus. In my observance, the most important aspect of math that is widely used, and that which people have the most trouble with, is algebra. Even in this class, people still have trouble doing basic algebra, including factoring, completing the square, and solving equations. Requiring people to take up to pre-calculus ensures that not only will they have learnt algebra, but they will become adept at it, because it will be reinforced through pre-calculus. Hence, based on this, high school and college students should be required to take math courses up through pre-calculus, regardless of their major. (Anthony Paulin, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7).

Albert Einstein was once quoted saying, "Do not worry about your difficulties in mathematics, I assure you that mine are greater" (quotes.com). However, there are people who happen to enjoy mathematics and find the problem solving interesting and exciting. A prime example of this is the famous mathematician from Budapest, Alfred Renyi, "If I feel unhappy, I do mathematics to become happy. If I am happy, I do mathematics to keep happy." (quotes.com). I realize that not all people like mathematics as much as others, when I was younger I hated math and I would do whatever I could to avoid a math class. But I discovered that it was only because I didn't understand some basic principles that are fundamental items a person would need to know to be able to perform mathematics. But now that I have achieved mastery of some of the minor things, I find mathematics fun and very easy to do. (John Thomas, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7). Like Adrian Mathesis said "The greatest unsolved theorem in mathematics is why some people are better at it than others." (quotes.com). http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7.

Mathematics is the basis for everything in this fast, growing technical world. Today, "less and less labor intense entry-level jobs" are available due to the fact that many of these jobs are being taking over by robotics and machinery that are much more cost efficient (1) If an educator's job is to prepare their students for the future and to be a part of this growing society then mathematics must be in every lesson plan, because society will never progress forward if math is thrown to the side. Therefore it is vital for all students to take math courses and to be enlightened on its everyday advantages. (Anthony Puntel, http://smartsheep.org/why-should-anyone-study-mathematics-honors-calculus-iii--fall-index-7). "Mathematics is the gate and key of the sciences. . . .Neglect of mathematics works injury to all knowledge, since he who is ignorant of it cannot know the other sciences or the things of this world. And what is worse, men who are thus ignorant are unable to perceive their own ignorance and so do not seek a remedy." (Roger Bacon). "To those who do not know mathematics it is difficult to get across a real feeling as to the beauty, the deepest beauty, of nature ... If you want to learn about nature, to appreciate nature, it is necessary to understand the language that she speaks in." (Richard Feynman, 1994)

What's Calculus?

Calculus is the mathematical study of change, in the same way that geometry is the study of shape and algebra is the study of operations and their application to solving equations. It has two major branches, differential calculus <http://bit.ly/JC9KfK> (concerning rates of change and slopes of curves), and integral calculus http://bit.ly/J5sG60 (concerning accumulation of quantities and the areas under curves); these two branches are related to each other by the fundamental theorem of calculus <http://bit.ly/1c13A3u>. Both branches make use of the fundamental notions of convergence of infinite sequences <http://bit.ly/1bdAI3s> and infinite series <http://bit.ly/1eoytlK> to a well-defined limit <http://bit.ly/1cR8EaQ>. Generally considered to have been founded in the 17th century by Isaac Newton <http://bit.ly/1hlBlOe> and Gottfried Leibniz <http://bit.ly/1kVEDHI>, today calculus has widespread uses in science, engineering and economics and can solve many problems that algebra alone cannot. (Wikipedia, 2013a)

Calculus is a branch of higher mathematics that deals with variable, or changing, quantities based on the concept of infinitesimals (exceedingly small quantities) and on the concept of limits (quantities that can be approached more and more closely but never reached). (Encyclopedia of Mathematics, 1982)

It should be emphasized that the Calculus means a variety of different things in different countries in a spectrum from:

- *informal calculus* – informal ideas of rate of change and the rules of differentiation with integration as the inverse process, with calculating areas, volumes etc. as applications of integration, to
- *formal analysis* – formal ideas of *completeness*, ε-δ definitions of limits, continuity, differentiation, Riemann integration, and formal deductions of theorems such as mean-value theorem, the fundamental theorem of calculus, etc., with a variety of more recent approaches including:

- infinitesimal ideas based on non-standard analysis,

- computer approaches using one or more of the graphical, numerical, symbolicmanipulation facilities with, orwithout, programming. (David Tall, 1993)

The calculus represents the first time in which the student is confronted with the limit concept, involving calculations that are no longer performed by simple arithmetic and algebra, and infinite processes that can only be carried out by indirect arguments. Teachers often attempt to circumvent the problems by using an “informal” approach playing down the technicalities. (Kline, 1998)

Calculus – “Language of Nature* and Gateway to Science, Technology, Engineering and Mathematics

High School

MAA/NCTM Recommends De-emphasis of Calculus

MAA/NCTM (2012) Joint Statement on Calculus

Although calculus can play an important role in secondary school, the ultimate goal of the K–12 mathematics curriculum *should not be to get students into and through a course in calculus by twelfth grade* but to have established the mathematical foundation that will enable students pursue whatever course of study interests them when they get to college. The college curriculum should offer students an experience that is new and engaging, broadening their understanding of the world of mathematics while strengthening their mastery of tools that they will need if they choose to pursue a mathematically intensive discipline. (MAA/NCTM, 2012)

College and University

Calculus Required STEM Majors

Despite the MAA/NCTM de-emphasis of high-school calculus, as far as I’m aware (please correct me if I’m wrong) a college-level course in calculus (or equivalent) is required for nearly all students who major in STEM disciplines, as well it should be considering that *Calculus is the Language of Nature.*A successful Calculus program must do more than simply ensure that students who pass are ready for the next course. It also needs to support as many students as possible to attain this readiness. And it must encourage those students to continue on with their mathematics. As I wrote in my January 2010 column "The Problem of Persistence" Bressoud (2010h) just because a student needs further mathematics for the intended career and has done well in the last mathematics course is no guarantee that he or she will decide to continue the study of mathematics. *This loss between courses is a significant contributor to the disappearance from STEM fields of at least half of thestudents who enter college with the intention of pursuing a degree in science, technology, engineering, ormathematics (David Bressoud, 2013b).*

I am concerned by these good students who find calculus simply too hard. As I documented in my column from May 2011, ‘The Calculus I Student’ [Bressoud (2011a)], these students experienced success in high school, and an overwhelming majority had studied calculus in high school. They entered college with high levels of confidence and strong motivation. Their experience of Calculus I in college has had a profound effect on both confidence and motivation. (David Bressoud, 2013b).

The solution should not be to make college calculus easier. However, we do need to find ways of mitigating theshock that hits so many students when they transition from high school to college. We need to do a better job ofpreparing students for the demands of college, working on both sides of the transition to equip them with the skillsthey need to make effective use of their time and effort (David Bressound, 2013b).

Twenty years ago, I surveyed Calculus I students at Penn State and learned that most had no idea what it means to study mathematics. Their efforts seldom extended beyond trying to match the problems at the back of the section to the templates in the book or the examples that had been explained that day. *The result was that studyingmathematics had been reduced to the memorization of a large body of specific and seemingly unrelated techniquesfor solving a vast assortment of problems. No wonder students found it so difficult. I fear that this has not changed.* (David Bressound, 2013b).

A deeper understanding of Calculus from a geometric and numerical as well as analytic point of views Calculus students today are making extensive use of modem technology; regularly completing long-term assignments; and frequently participating actively as members of study groups and activity teams. Ten years ago these activities were virtually unheard of in college mathematics classes. . . . . It should be acknowledged, however, that some college and university mathematicians believe that the increased use of technology, the introduction of more applications, and the increased emphasis on student communication is a change in the wrong direction. In addition, *there are others who believe that more evidence of improved student learning is necessary before a final decision can be made concerning the ultimate value of the change*.” (William Haver, 1998). A number of reports that present programmatic information and indicators of success in the efforts to incorporatetechnology and sound pedagogical methods in calculus courses have indeed been written. Reform has received mixedreviews, with students seemingly faring better on some measures, while lagging behind students in traditional courseson others However, these reports *present only limited information on student learning in reform courses*,primarily because the collection of reliable data is an enormous and complicated task and concrete guidelines on how toimplement meaningful evaluations of reform efforts simply do not exist. The need for studies that determine the impactof these efforts, in combination with the increase in workload brought on by reform, is creating an environment ofuncertainty. Funding agencies, institutions, and faculty require the results of such studies to make informed decisionsabout whether to support or withdraw from reform activities. (Susan Ganter, 1990).

I am distressed by how poorly these students do in Calculus I: Over a quarter essentially fail, and only half earn the A or B that is the signal that they are likely to succeed in further mathematics. I know the frustration of high school teachers who see what they consider to be the best and brightest of their students run into mathematical roadblocks in college. I recognize that much of the fault lies on the high school side of the transition. Many students who consider themselves well prepared for college mathematics in fact are not. We need to do a better job of communicating what these students really need and working with their teachers so that they can provide it. I also know that we in the colleges and universities can do a better job of supporting these students after they have arrived on our campuses, moving them forward with challenging and engaging mathematics while bringing them up to the level they need to be at to succeed. (David Bressoud, 2011b).

The movement to change the nature of the calculus course at the undergraduate and secondary levels has sparked discussion and controversy in ways as diverse as the actual changes. The first years of the calculus reform movement were characterized by a whirlwind of ideas concerning the organization of the course and the associated curriculum. The papers contained [in this book] will spark a renewed interest in the endeavor embarked upon over 10 years ago when the first calculus grants were awarded by the National Science Foundation (NSF). This book intends to address: relating mathematics to other disciplines; determining the appropriate mathematical skill for students exiting first-year collegiate mathematics courses; determining the appropriate role of technology; determining the appropriate role of administrators in the change process; and evaluating the progress and impact of curricular change (Ganter, 2000).

Calculus is one of the great achievements of the human intellect. It has served as the language of change in the development of scientific thought for more than three centuries. The contemporary importance of calculus includes applications in economics, psychology, and the social sciences and continues to play a key role in its traditional areas of application. Our students' interests and preparation are changing—see Bressoud (2004, 2010a-g), Stroyan (2006)—but calculus deserves a place in the curriculum of educated people in many walks of life, not only as technical preparation for careers in math and the physical sciences. Here I suggest a method to improve reasoning skills, promote teamwork, and capture the interest of a broad spectrum of college students. Student projects can engage students in realistic problems they find interesting but, more importantly, they can help students synthesize and apply the knowledge gained by working template exercises and can send a message that the subject can solve real problems. (Stroyan, 2011).

Deep concerns in mathematical education have converged, like currents in the ocean, to generate both a certain amount of froth and a strong force for reform of calculus instruction. First there are the dual concerns of adapting to the needs of a burgeoning number of computer science majors and of making use of new technologies in microcomputers and hand-held calculators. Second is alarm at the decline of the presentation of calculus into an arcane study of detailed techniques of differentiation, integration, and tests for convergence of series, with artificial set piece problems that may be checked by making sure the answer is simple. Students see little of the towering intellectual achievement of the subject, and they cannot see how to formulate physical problems of change and constancy as mathematical ones involving differentiation and integration. Moreover, even many of the best students remain unable to unite English expressions and mathematical symbolism in a single coherent sentence, much less in an acceptable student paper on a mathematical subject (Douglas, 1986)

While there is some agreement regarding the breadth and conceptual orientation of a desirable calculus course, there is evidence to suggest that the calculus that is actually taught is 'the moral equivalent of long division.' An examination of final examination questions in collegiate calculus courses (Steen, 1987) revealed that 90 percent of the items focused on calculation and only 10 percent on higher order challenges. Steen suggests that the curriculum of collegiate calculus has changed dramatically in the last two or three decades and that the change has not been a good one. He feels that the movement has been away from conceptual understanding about the nature of calculus and toward more 'plug and crank' exercises, with undue emphasis on computation and manipulative skills. Whether or not one accepts this view, it is certainly the case that far too much time is spent in most calculus courses doing things that are best done by machines. (Kasten and Others, 1988).

With these assumptions in mind, one of the objectives of the Calculus Initiative (CI) at the University of Minnesota, a project which successfully revitalized the undergraduate calculus sequence for engineering students, was to introduce changes in pedagogy and practice that made faculty aware of the value of such efforts. The CI emphasized (i) how the active learning approaches enhanced the faculty's own success as teachers; and (ii) how these methods improved student motivation and learning of important classical calculus topics. In this sense, many of the Initiative's efforts were devoted to innovative ways of providing professional development for the diverse members of the CI instructional teams—senior faculty, post-doctoral fellows, visiting faculty, graduate students, teaching specialists (many of whom were outstanding high school teachers on sabbatical), and undergraduate teaching assistants. A major objective was to provide a mentoring environment that helped each of these groups to be accepting of and successful in both short- and long-term implementation of these changes, which incorporated modem instructional approaches. The results of a four-year study of the CI are given in Keynes, Olson, O'Loughlin and Shaw (2000) (Keynes and Olsen, 2001).

Calculus & Its Origins is an overview of calculus as an intellectual pursuit having a 2,000-year history. Author David Perkins examines the extent to which mathematicians and scholars from Egypt, Persia, and India absorbed and nourished Greek geometry, and details how the scholars wove their inquiries into a unified theory. Chapters cover the story of Archimedes'discovery of the area of a parabolic segment; Ibn Al-Haytham's calculation of the volume of a revolved area; Jyesthadeva's explanation of the infinite series for sine and cosine; Wallis's deduction of the link between hyperbolas and logarithms; Newton's generalization of the binomial theorem; Leibniz's discovery of integration by parts—and much more. Each chapter also contains exercises by such mathematical luminaries as Pascal, Maclaurin, Barrow, Cauchy, and Euler. Requiring only a basic knowledge of geometry and algebra—similar triangles, polynomials, factoring—and a willingness to treat the infinite as metaphor—*Calculus & Its Origins* is a treasure of the human intellect, pearls strung together by mathematicians across cultures and centuries.(Perkins, 2012)

MATERIALS AND METHODS

The Calculus examination covers skills and concepts that are usually taught in a one-semester college course in calculus. The content of each examination is approximately 60% limits and differential calculus and 40% integral calculus. Algebraic, trigonometric, exponential, logarithmic, and general functions are included. The exam is primarily concerned with an intuitive understanding of calculus and experience with its methods and applications. Knowledge of preparatory mathematics, including algebra, geometry, trigonometry, and analytic geometry is assumed.

The observation imposed to 176 students as random sampling of 775 students who are attending faculty mathematics and natural science of Medan State University. The examination contains 44 questions, in two sections, to be answered in approximately 90 minutes. Any time candidates spend on tutorials and providing personal information is in addition to the actual testing time.

Evaluation on testitems is preliminary previewed about its reliability and validity and normality, homogeneity, linearity, colinearity are met before the testing time due.

- Section 1: 27 questions, approximately 50 minutes.□ No calculator is allowed for this s section.
- Section 2: 17 questions, approximately 40 minutes. □The use of an online graphing calculator (non-CAS) is allowed for this section. Only some of the questions will require the use of the calculator

Knowledge and Skills Required

Questions on the exam require candidates to demonstrate the following abilities

- Solving routine problems involving the techniques of calculus (approximately 50% of the exam)
- Solving non-routine problems involving an understanding of the concepts and applications of calculus (approximately 50% of the exam)
- Solving non-routine problems involving an understanding of the concepts and applications of calculus (approximately 50% of the exam)

Sample Question 1 of 5

What is $\lim_{x \to 1} \frac{1-x^2}{x^4-x}$?
-2
$-\frac{2}{3}$ @
$\frac{2}{3}$
1
The limit does not exist

What is the slope of the line tangent to the graph of the function $f(x) = In(\sin^2 x + 3)$ at the point where $x \frac{\pi}{3}$?
$\frac{1}{15}$
$\frac{\sqrt{3}}{15}$
$\frac{2\sqrt{3}}{15}$ @
$\frac{4}{15}$

Let $f(x)=\sqrt{2x+1}$ ifg is the inverse function of f, then g'(3)=

$\frac{1}{2\sqrt{7}}$

$\frac{1}{\sqrt{7}}$

$\frac{1}{3}$

$\sqrt{7}$

3 @

Oil is poured on a flat surface, and it spreads out forming a circle, The area of this circle is increasing at a constant rate of 5cm^2/s. At what rate, in cm/s, is the radius of the circle increasing when the radius is 5cm?

$\frac{1}{2\pi}$ @

$\frac{1}{\pi}$

1

π

2π

Let f be a continuous function on the closed interval [0,3], and let c be a point in [0, 3] such that $f(c)=2$ is a maximum value of f on [0, 3], Which of the following CANNOT be true?

f is increasing on [0, 3]

f is decreasing on [0, 3]

$f(x)=x(3-x)-\frac{1}{4}$

$\int_0^3 f(x)dx=7$ @

$\int_0^3 f(x)dx=5$

RESULTS AND DISCUSSION

Observation (Research) Findings

=

Problem Constellation Model

Relation of X_i(i=1,2,3) each with Y

X_1

Relation of *Xi*impacts Y

=

Y

X_2

Y = Calculus Learning Outcome

X_1= Mathematical Intelligence

X_2= Reaction/Attitude on Calculus

X_3 = Teaching Competence

X_3

Table 1. ANOVA (Analysis of Variance) Test Significance and Linearity of equal regression Y=5.71+0.59X_1

Variance Source	df	Sum of Squares	Mean Square	F_{count}	F_{table}	
					0.05	0.01
Total	176	57047				
Regression(a)	1	5323.032				
Regression (b/a)	1	227.588	227.588	25.495**	3.90	6.78
Residual						
	174	1536.380	8.830			
Unmatched	19	146.003	7.684	0.857^{ns}	1.64	2.00
Error	155	1390.357	8.970			

**: very significant regression (F_{count}= 25.495 > F_{table} = 6.78)

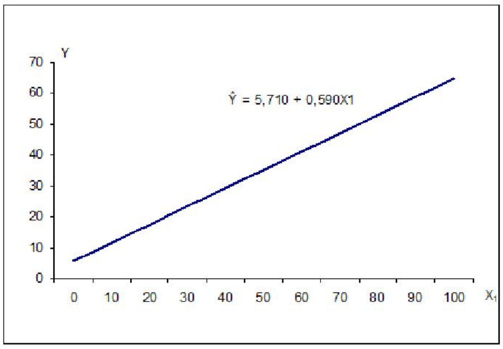
ns : linearity form (F_{count} = 0.636 < F_{table} = 1.64)

Explanation:

SS = Sum of Squares

df = degree of freedom

Regression Graphic Y=5,710 + 0,590X



15

Correlation Between Mathematical Intelligence (X_1) and Calculus Learning Outcome (Y)

The result of examined hypothesis by simple regression which pairing with mathematical intelligence (X_1) and with calculus learning outcome (Y) acquired coefficient toward regression of 0.59 and constant value 5.71. Equation of Regression is Y=5.71 + 0.59 X_1. Examined linearity is carried out to view whether regression equation has been linear or not, with the end results of $F_{count}>F_{table}$ (0.01)(1:176) its significant. The end of calculation is equally$F_{count}$of 25.49 meanwhile F_{table} 6.78 meant itssignificant. The applicable measurement is when $F_{count}<F_{table}$(0.05)(19:155). Since F_{count} of 0.857 andF_{table} is 1.64 or$F_{count}<F_{table}$ implied equation of regression is linear. Based on this run its assumable that equation of regressionis Y=5.71 0.59 X_1 its significant and related linear. Means that any mathematical intelligence units upsurge will cause of 0.59 calculus units learning outcome arising in the line of constant 5.71. Conclusively to justify that mathematical intelligence is coherently correlated with calculus learning outcome.

The another point of view in virtue of strong correlation between mathematical intelligence (X_1)and calculus learning outcome(Y) is by carrying out with calculating correlation. Calculative equation of correlative coefficient of 0.66. In order to verify correlative coefficient that is significant is to examine *t* along with criterion: if $t_{count}>t_{table}$ correlation is significant. The ultimate examined *t* therefore t_{count} of 15.50 and t_{table} of 2.57 (Table 2).

Table 2. Table of Examining Significance between Correlation of X_1 with Y

N	Correlative of Coefficient (r_{y1})	t_{count}	T_{table}	
			$\alpha = 0.05$	$\alpha = 0.01$
176	0.66	15.50	1.96	2.57

Explanation:
**= Correlative Coefficient is very significant (t_{count} = 15.50 >t_{table} = 2.57 on $\alpha = 0.01$)
n = Total Sample

The end of examined significant correlative coefficient between mathematical intelligence (X_1) and calculus learning outcome(Y) of 0.66 its significant. To refute the notion hypothesis null (H_0) about to nullify immediate correlation between mathematical intelligence and calculus learning outcome, rather adopting H_1 to concede a positive correlation themselves. Correlative coefficient (X_1) and (Y) is 0.66 and determinant coefficient of 0.435 or 43.5% variance of variable of calculus learning outcome, unequivocally inferred an immediate effect of mathematical intelligence. The partial calculation of correlative coefficient (X_1) and (Y) by retaining (X_2) and (X_3) partially or intact winds up partial correlative coefficient $_{y1,2}$ = 0.53,$r_{y1.3}$ = 0.57, and $r_{1,23}$ = 0.49. The figure in table 2 presented (X_1) and(Y) withheld (X_2) meant $r_{y1.2}$ = 0.53 (significant). Correlation between (X_1) and (Y) withheld (X_3) acquired partial correlative coefficient $r_{y1\ 3}$ = 0.57 (significant). Correlation between (X_1) and (Y) controlled (X_2) and (X_3) obtained partial correlative coefficient $r_{y1\ 23}$ = 0.49 (significant). The summary of partial correlative coefficient is exhibited on Table 3 and Table 4.

Table 3. The End of Examined Partial SignificantCorrelative Coefficient Between X_1 and Y

Correlation	Controlled	Notation	Correlative Coefficient	t_{count}	t_{table}	
					$\alpha = 0.05$	$\alpha = 0.01$
$X_1$and Y	X_2	$r_{y1.2}$	0.53	9.70**	1.96	2.57
$X_1$and Y	X_3	$r_{y1.3}$	0.57	11.10**	1.96	2.57
$X_1$and Y	$X_2$and X_3	$r_{y1.23}$	0.49	8.62**	1.96	2.57

** :Correlative Coefficient is very Significant(T_{count}= 9.70 >T_{table} = 2.57, $\alpha = 0.01$)
** : Correlative Coefficient is very Significant(T_{count}= 11.10 >T_{table} = 2.57, $\alpha = 0.01$)
** : Correlative Coefficient is very Significant(T_{count} = 8.62 >T_{table} = 2.57, $\alpha = 0.01$)
X_1 = Mathematical Intelligence
X_2 = Reaction/Aptitude on Calculus
X_3 = Teaching Competence
Y = Calculus Learning Outcome

Table 4. Examined Significant Correlative Coefficient between X_1 and Y

N	Correlative Coefficient	F_{count}	F_{table}	
			$\alpha = 0.05$	$\alpha = 0.01$
176	0.66	15.50**	1.96	2.57

Description:
** = Correlative Coefficient is very Significant(F_{count} = 15.50 >F_{table} = 2.57 for $\alpha = 0.01$)
n = total sample

Correlation between Reaction or Attitude Toward Calculus (X_2) and Calculus Learning Outcome (Y)

Table 5. Table ANOVA (Analysis of Variance) Examined Significant and Linear Equivalent Regression = -38.345 + 0.548 X_2

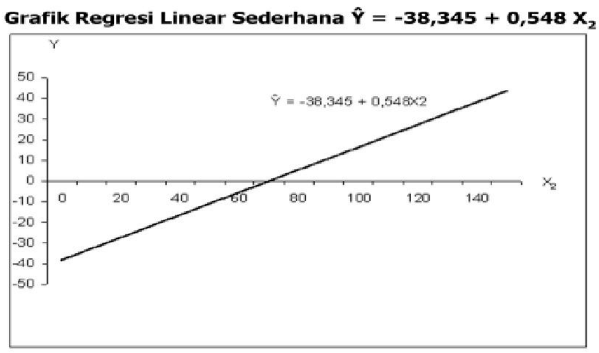
Source of Variance	Df	SS	MS	F_{count}	F_{table}	
					0.05	0.01
Total	176	57047				
Regression(a)	1	5323.032				
Regression (b/a)	1	227.588	227.588	25.163**	3.90	6.70
Residual	174	1536.380	8.830			
Unmatched	20	67.515	3.376	0.348^{ns}	1.64	2.00
Error	154	1495.401	9.710			

**: regression is very significant(F_{count}= 25.163 > F_{table} = 6.70)
ns : the form of linearity connection (F_{count} = 0.348 < F_{table} = 1.64)

Description

SS = Sum of Squares
df = Degree of freedom
MS = Total Mean Square

This figure is magnifying correlation between reaction or attitude toward calculus (X2) which conjunct with itscalculus learning outcome (Y) by equivalent regression $Y=-38.345+0.548X_2$. The summary of variance analysis result is exhibited on Table 5. In order to bring up to view of equivalent significant regression by examined F with assessable measurement, if $F_{count}>F_{table}$ means its significant. The figure is F_{count} of 25.163 and F_{table} = 6.70 (significant). The end calculation of equivalent regression Y=-38.345+0.548X_2 considerably as tool to wind up correlation between reaction or attitude toward calculus (X_2) and calculus learning outcome (Y) is significant. Another verification of that correlation is by examined F with criterion if $F_{count}<F_{table(0,05)(20.154)}$and F_{count} = 0,348 <$F_{table\ (0.01)(20.154)}$ = 1.64. that means equivalent regression is linear. Another interpretation is that an upsurge one unit reaction on calculus (X_2) will turn up 0.55 unit calculus learning outcome (Y) its parallel with constant of 38.34.



Simple Linear Regression Graph

Another way to more emphasize the correlation between reaction or attitude toward calculus (X_2) and calculus learning outcome (Y) with calculation correlative coefficient of r_{y2}=0.68. Demonstrated on the Table 6.

Table 6. ExaminedSignificant Correlative Coefficient between X_{2and} Y

N	Correlative Coefficient	t_{count}	t_{table}	
			$\alpha = 0.05$	$\alpha = 0.01$
176	0.68	16.78	1.96	2.57

Description:
** = correlative coefficient is very significant (F_{count} = 16.78 >F_{table} = 2.57 at $\alpha = 0.01$) n = total sample

The correlativecoefficientreactionorattitudetowardcalculus (X_2) and calculuslearningoutcome (Y) is 0.68 and itsdeterminantcoefficientis 0.459 or 45.9%variance of variablecalculuslearningoutcome(Y) infusedbyreactionorattitude on calculus (X_2) and the rest of it is distractedbyanotherfactors. The explisitcalculation of (X_2) and (Y) byholding back (X_1) and (X_3) partiallyorintactspawned$r_{y2.1}$ = 0.57,$r_{y2.3}$=0.59 and $r_{y2.13}$=0.51. And its assumably that (X_2) and (Y) by under-controlling (X_1) turned to $r_{y2.1}$=0.57 (significant). Correlation (X_2) with (Y) and taking control (X_3) spawned partial correlative coefficient $r_{y2.3}$ = 0.59 (significant). Correlation between (X_2) and (Y) and taking control of (X_1) and (X_3) coming up with $r_{y2.13}$=0.51 (significant). The summary of examined partial correlative coefficient between reaction or attitude toward calculus (X_2) and calculus learning outcome (Y) is exhibited on the Table 7.

Table 7. Summary Calculative Partial Correlative Coefficientand Examined Significance Between $X_2$and Y

Correlation	Controlled	Notation	Correlative Coefficient	t_{count}	t_{table}	
					$\alpha = 0.05$	$\alpha = 0.01$
$X_2$and Y	X_1	$r_{y2.1}$	0.57	11.10**	1.96	2.57
$X_2$and Y	X_3	$r_{y2.3}$	0.59	11.90**	1.96	2.57
$X_2$and Y	$X_1$and X_3	$r_{y2.13}$	0.51	9.06**	1.96	2.57

Description :

**very significant partial correlative coefficient(t_{count} = 11,10 >t_{table} = 2,57 $\alpha = 0,01$)

**very significant partial correlative coefficient(t_{count} = 11,90 >t_{table} = 2,57 $\alpha = 0,01$)

**very significant partial correlative coefficient(t_{count} = 9,06 >t_{table} = 2,57 $\alpha = 0,01$)

X_1 = Mathematical Intelligence
X_2 = Reaction /Attitudeon Calculus
X_3 = Teaching Competence
Y = Calculus Learning Outcome

Correlation Between Teaching Competence(X_3) and Calculus Learning Outcome (Y)

Students' assessment on teaching competency (X_3) will imbue a success of class attendance. Hypothesis of the three researches were found a ground positive correlation between students' assessment on teaching competency (X_3) and calculus learning outcome (Y). The result of examined hypothesis with simple regression acquired coefficient toward regression (b) of 0.577 and constant value (a) -36.178 equivalent regression Y=-36.178+0.577X_3. Analysis summary on the Table 8.

Table 8. ANOVA (Analysis of Variance) Examined Significance and Linearity Equivalent Regression Y = -38,34 + 0,58 X_3

Source of Variance	Df	SS	MS	F_{count}	F_{table}	
					0.05	0.01
Total	176	57047				
Regression(a)	1	5323.051				
Regression (b/a)	1	247.218	247.218	32.678**	3.90	6.70
Sisa	174	1334.731	7.671			
Unmatched	20	123.642	6.507	0.833ns	1.64	2.00
Error	154	1211.089	7.813			

**: very significant regression (F_{count}= 32.678 > F_{table} = 6.70)

ns : linearity form (F_{count} = 0.833 < F_{table}= 1.64)

Description:

SS = Sum of Squares
df = Degree of Freedom
MS = Mean of Squares

In conjunction with equivalent significant regression, carried out by means of examined F with evaluating criterion is if F_{count}>F_{table}= 6.70 (significant). By calculativeon the Table 8 above that equivalent regression Y = -36.178+0.77X_3(significant) can take it as a tool to enlighten about correlation between teaching competence(X_3) and calculus learning outcome (Y). The correlation (X_3) and (Y)by examined F with criterion if F_{count}>$F_{table(0.01)(19.155)}$ equivalent regression is linear. From the Table 8 above its clear that F_{count}= 0.833>$F_{table(0.05)(19.155)}$ = 1.64. That (X_3) and (Y) is linear, conclusively that equivalent regression Y=-36.178+0.577X_3 is significant and linear. In other words that any turn one unit up (X_3) willkeep up 0.577 unit (Y) in accord with constant -36.345. In other perspective to discern correlation between (X_3) and (Y) with calculative correlative coefficient of r_{y3} = 0.71. To verify more by examined t is exhibited on the Table 9.

Table 9. ExaminedSignificant Correlative Coefficient Between $X_3$and Y

N	Correlative Coefficient	t_{count}	t_{table}	
			$\alpha = 0.05$	$\alpha = 0.01$
176	0.74	16.78**	1.96	2.76

Description:

** =very significant correlative coefficient (F_{count} = 30.37 >F_{table}= 2.57, with $\alpha = 0.01$)

n = total sample

The correlativecoefficientteachingcompetency (X_3) and calculuslearningoutcome (Y) is 0.74 and itsdeterminantcoefficient is 0.54 or 54% variance of variablecalculuslearningoutcome (Y) infusedbyteachingcompetence(X_3) and the rest of it is distractedbyanotherfactors. The explisitcalculation of (X_3) and (Y) by holding back (X_1) and (X_2) partiallyorintactspawnedr$_{y3.1}$ = 0.72, $r_{y3.2}$=0.68 and $r_{y3.12}$=0.70. And itsassumably that (X_3) and (Y) by under-controlling (X_1) its significant. Correlation (X_2) with (Y) and taking control (X_3) its significant. Correlation between (X_3) and (Y) and taking control of (X_1) and (X_2) its significant. The summary of examined partial correlative coefficient between teaching competence (X_3) and calculus learning outcome (Y) is exhibited on the Table 10.

Table 10. Summary Calculative Partial Correlative Coefficientand Examined Significance Between X_3 and Y

Correlation	Controlled	Notation	Correlative Coefficient	t_{count}	t_{table}	
					$\alpha = 0.05$	$\alpha = 0.01$
$X_2$and Y	X_1	$r_{y3.1}$	0.72	12.40**	1.96	2.57
$X_2$and Y	X_2	$r_{y3.2}$	0.68	10.70**	1.96	2.57
$X_2$and Y	$X_1$and X_2	$r_{y3.12}$	0.86	10.02**	1.96	2.57

Description:

**very significant partial correlative coefficient(t_{count} = 12,40 >t_{table} = 2,57 $\alpha = 0{,}01$)

**very significant partial correlative coefficient(t_{count} = 10,70 >t_{table} = 2,57 $\alpha = 0{,}01$)

**very significant partial correlative coefficient(t_{count} = 10,02>t_{table} = 2,57 $\alpha = 0{,}01$)

X_1 = Mathematical Intelligence
X_2 = Reaction /Attitudeon Calculus
X_3 = Teaching Competence
Y = Calculus Learning Outcome

Correlation Between Mathematical Intelligence (X_1) and Reaction or Attitude Toward Calculus (X_2) and Teaching Competence (X_3) and Calculus Learning Outcome (Y).

Fourth hypothesis is dealing with correlation between (X_1) and (X_2) and (X_3) and (Y). The figures reflected coefficient moved toward multiple regression for (X_1) of 0.230; while (X_2) of 0.257, and (X_3) 0.304 with that of -41.51. The equations can form multiple equivalent regression Y=-41.515+0.230X_1+0.257X_2+0.304X_3.To bemore detailed equivalent significant multiple regression, therefore carried out by examined F which exhibited on the Table 11.

Tabel 11. ANOVA (Analysis ofVariance) Examined Significance and Linearity Regressive Equation

$$\hat{Y} = -41{,}515 + 0{,}230X_1 + 0{,}257X_2 + 0{,}304X_3.$$

Source of Variance	Df	SS	MS	F_{count}	F_{table}	
					$\alpha = 0.05$	$\alpha = 0.01$
Total	176	5704				
Coefficient	1	5323.051				
Total Corrected	175	380.949				
Regression	3	3243.361	1081.12	38.19**	2.66	3.90
Residual	172	566.588	3.294			

Description:

**very significant multiple regression (F_{count} = 38.197>F_{table} = 3.90)
SS = Sum Squares
df = degree of freedom
MS = Mean of Squares

Look into the Table 10 above derivedF_{count}>F_{table} = (38.197 > 3.90) says that (X_1) and (X_2) and (Y) is positive. Therefore the equivalent model of multiple regression Y=-41.515+0.230X_1+0.257X_2+0.304X_3its justifiable to interpret correlation between dependent variable and independent variable. The end of calculation carried out by correlative coefficient of $r_{y.123}$of 0.86 which exhibited on the Table 12.

Table12. Examined Coefficient Multiple Correlation for X_1, X_2, $X_3$with

$$\hat{Y} = -41{,}515 + 0{,}230X_1 + 0{,}257X_2 + 0{,}304X_3.$$

First Correlation	Correlative Coefficient	Determinant Coefficient	F_{count}	F_{table}	
				α =0.05	α =0.01
X_1,X_2,$X_3$with Y	0.86	0.74	16.06**	2.66	3.90

Description:

** = very significant correlative coefficient (F_{count} = 32.06 >F_{table}= 16.06 for α =0.01)
n = total sample

The result of examined multiple significant correlative coefficient implied linkage between (X_1) and (X_2) and (X_3) and (Y) with multiple correlative coefficient $r_{y123} = 0.86$. To specifycorrelative coefficient carried out by determinant coefficient $R_{y.123}$ of 0.74 which means 74% variance of (Y) effected by (X_1), (X_2), (X_3)concurrently, the rest influenced by other variable. The strong linkage is exhibited on the Table 13.

Table 13. The Table of Rank about Correlation Between Mathematical Intelligence (X_1) and Reaction or Attitude Toward Calculus (X_2) and Teaching Competence (X_3) and Calculus Learning Outcome (Y)

Partial Coefficient Correlation	t_{count}	Rank
$r_{y1.23} = 0.49$	8.62**	Third
$r_{y2.13} = 0.51$	9.06**	Second
$r_{y3.12} = 0.70$	10.02.**	First

The figure on the Table 12 above placed the rank of strong three correlated in/dependent variable whereby teaching competence (X_3) sits on top the first place with $r_{y3.12} = 0.59$. Variable reaction or attitude toward calculus (X_2) leveled on the second stage with $r_{y3.12} = 0.51$. Variable mathematical intelligence (X_1) contributes on the thirdphase but grounded with $r_{y1.23} = 0.49$. Blatantly, in fact, that correlative coefficient of teaching competence (X_3) is the strongest domain factor to stir up or promulgate or shifting students' Calculus Learning Outcome (Y).Reaction or attitude toward calculus (X_2) positively spurs intents and awareness in reacting to bring aboutcalculus learning outcome (Y). By teaching competence (X_3) and reaction on calculus (X_2) is the path to make better teaching objective.Mathematical Intelligence (X_1)itself being the third least consecutive impact on calculus learning outcome (Y).

Discusstions (Reviews)

Hypothesis that fused mathematical intelligence (X_1), reaction or attitude toward calculus (X_2), and teaching competence (X_3) along with calculus learning outcome (Y). The calculation of coefficient toward multiple regression to (X_1) of= 0.230; to (X_2) of 0.257; to (X_3) of 0.304 with that of 41.5. The calculation can form multiple equivalent regression $Y=41.515+0.230X_1+0.304X_3$. By multiple equivalent regressionpresumed it works as simultaneous variable: mathematical intelligence (X_1), reaction or attitude toward calculus (X_2), and teaching competence (X_3) had led contributing calculus learning outcome (Y). By the calculationof multiple correlative coefficientof ($X_{1.2.3}$) and (Y), can interpret a strong connectivity of three variables with multiple correlative coefficient r_{y123} of 0.86 and determinant coefficient R_{y123} of 0.74 or 74% variable of (Y) is a direct impact by (X_1), (X_2), (X_3) and the rest by other factors. The stage of rank displaying variable(X_3)sits on very top the first place that is $r_{y3,12} = 0.70$, variable (X_2) positionedon the second place with $r_{y2.13}= 0.51$, variable (X_1) led to the third (floor) place with $r_{y1.23} = 0.49$. Otherwise, institutional or educationalpractitioner strongly to advocatethat teaching competence (X_3) as a culmination issue must have focused priority among these three variables observed within Natural Science and Mathematics Faculty of Medan State University in particular.

Conclusion and Recommendation

Conclusion

This research disclosed those three variables of mathematical intelligence (X_1), reaction or attitude toward calculus (X_2), and teaching competence (X_3) are solidly determinant integration to calculus learning outcome accomplishment. Endeavour to achieve calculus learning outcome (Y) should have referred on those three variables.

Recommendation

On the results of discovery, explanation, conclusion, the writer will pass on some recommendations into how to enhance mathematical intelligence (X_1), reaction or attitude toward calculus (X_2) ,teaching competence (X_3) in order to make better calculus learning outcome (Y)

In order to elevate mathematical intelligence (X_1)

- To fresh undergraduates of Medan State University demanded to provide the so-called Crash Program with available literatures
- Provide matriculation to get students ready into teaching learning strategy
- To complement mathematical literatures

In order to make up reaction or attitude toward calculus (X_2)

Attempt to take a turn for the better reaction or attitude toward calculus is not as easy task as flip over palm hand, entailed encouragement, gentle persuasive to rekindle, to revitalize, to make up mind to be fond of studying calculus. In this faculties the author has no latent qualified advisories about it.

In order to augment teaching competence (X_3)

Enticed comprehensive encouragement qualitatively and quantitatively to calculus' lecturers/tutors. In this article the writer does not have any qualifications for suggestions even intensively or extensively, how much more about qualitatively or quantitatively, rather just to recommend to propose seminar, training, upgrade, exercising skill to the concerned lecturers/tutors.

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