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A Comparative Study of the Attitudes, Views, and Difficulties of Engineering and Business Students about the Function of Mathematics Courses at Tertiary Level

Ambreen Zehra[1], Sarwar Jahan Abbasi[2], Naazrah Zahid Shaikh[3], Sadia Ali[4]

[1]Assistant Professor, Department of Computer System Engineering, Faculty of Engineering, Science and Technology, Hamdard University Main Campus, Karachi, Pakistan

[2]Professor, Department of Mathematics, University of Karachi, Karachi, Pakistan

[3]Senior Lecturer, Department of English, Faculty of Social Sciences and Humanities, Hamdard University Main Campus, Karachi, Pakistan

[4]Assistant Professor, Department of Bio-Medical Engineering, Faculty of Engineering, Science and Technology, Hamdard University Main Campus, Karachi, Pakistan

Abstract

Engineering and business studies expertise is a key of sustaining a modern economy and to the advancement of civilization. Mathematics is a significant course which helps to understand the fundamentals of engineering and business principles. This study was an investigation about the attitude of business and engineering students towards Mathematics courses. The purpose of this study was to explore the relation between attitude and internal factors that effect on Mathematics studies. Furthermore, how Mathematics is useful in their professional life and how helpful advance technology to learn mathematics and made it interesting. A Survey was conducted to analyzing the attitude of engineering and business students towards Mathematics courses. The data was collected carefully according to the requirement.

The research population in this study was engineering and business school students in Karachi-Pakistan. In this study attitude was measured in cognitive, affective and behavior domains for finding the factors that affect the learning of Mathematics among business and engineering students. Theories and related researches were used for making a questionnaire research tool.

The finding of this research is helpful for improvement of Mathematics teaching and learning in both professions. In further, this study is also being beneficial for administration. The results of this studies shows that students attitude effect on their Mathematics learning, good mathematical skills made their professional journey easy and attitude of both gender also different towards Mathematics courses. The integration of technology also made teaching and learning interesting. Lastly, the mathematical skills are used in professional engineering field and the business world as per their need.

Keywords

Engineering, Business, Modern Economy, Advancement of Civilization

1. Introduction

Mathematics is almost as old as humanity itself. The word mathematics is a Greek word and the meaning of this word is knowledge, teaching and learning. In 2001, Seline stated that mathematics is the study of patterns, variability, shape, and measurement [1]. Mathematics plays a fundamental role in the development of science, technology, business, and philosophy. In other words, mathematics has evolved from simple counting, calculation, measurement, and the systematic study of the shape and motion of physical objects through the application of abstraction, imagination, and logic, into the extensive, complex, and often abstract discipline we know today.

An English rationalist Roger Bacon quotes about Math "Disregard of Math works injury to all information, since one who is oblivious to it can't have the foggiest idea about different studies of this world". Math is a huge subject, which upholds an enormous number of bad-to-the-bone designing and business concentrates on courses. Therefore, five Math courses have been shown in various semesters of designing and business learns at tertiary level. Understudies ought to hold major areas of strength for information on Science that can save their inspiration for fair advancement in their examinations.

In designing calling requires an unmistakable comprehension of Math, sciences and innovation [2]. It is broad believed that Arithmetic is "the critical scholarly obstacle" in the stockpile of designing alumni. In overseeing business and business concentrates on Science is a significant part. Business endeavors utilized Math to keep a record and handle business tasks. These associations use Arithmetic in bookkeeping, showcasing, deals anticipating and monetary examination.

Designing enterprises utilized Science to take care of their concerns like, chart hypothesis uses in media communications industry, streamlining procedures to visualize the most worthwhile spots to bore for oil and mathematical examination to tackle complex issues of programming houses and so on. In overseeing business and business concentrates on Arithmetic is a significant part. Business undertakings utilized Math to keep a record and handle business tasks. These associations use Science in bookkeeping, promoting, deals determining and monetary examination.

Mathematics is universally regarded as the foundation of knowledge, science, and innovation. For students in business and engineering, its importance is even more pronounced because it serves as both a theoretical framework and a practical tool to navigate academic, professional, and real-world challenges. While mathematics is often seen as an abstract subject, its role in shaping the intellectual and career pathways of business and engineering students is critical. It equips them with the analytical, logical, and problem-solving skills necessary to succeed in highly competitive and rapidly changing environments.

One of the foremost contributions of mathematics to business and engineering students is the development of quantitative and analytical thinking. In engineering, mathematical concepts such as calculus, differential equations, and linear algebra are directly applied to design, analyze, and optimize systems. Whether it is building bridges, developing software, or designing electrical circuits, mathematics provides engineers with the tools to model reality and predict outcomes with precision. Similarly, business students rely on mathematics for decision-making in finance, economics, and management. Concepts of probability, statistics, and optimization enable them to evaluate risks, interpret data, and make informed choices that directly impact organizational success.

Mathematics also plays a crucial role in technological innovation and problem-solving, areas that are at the heart of engineering education. Engineering students are trained to solve real-world problems through mathematical modeling and computational simulations. For example, differential equations are used to analyze fluid dynamics, while linear programming is applied to optimize industrial processes. Business students, on the other hand, use mathematical models to forecast market trends, allocate resources efficiently, and measure the financial health of companies. With the increasing reliance on data analytics and digital technologies, both fields converge on the need for strong mathematical literacy.

Another dimension of importance lies in career readiness and professional growth. Employers in both business and engineering fields demand professionals who can apply logical reasoning, interpret numerical data, and communicate results effectively. An engineering graduate who understands advanced mathematics is better positioned to design innovative solutions, while a business graduate proficient in quantitative methods is more capable of analyzing big data, understanding financial markets, and making evidence-based decisions. Thus, mathematics serves as a common language that connects academic knowledge with practical workplace demands.

In addition, mathematics nurtures essential cognitive and personal skills. Problem-solving in mathematics fosters resilience, critical thinking, and creativity. Business and engineering students often encounter complex, open-ended challenges in their studies and future professions. Mathematics trains them to break problems into manageable parts, identify patterns, and propose systematic solutions. This mindset goes beyond academics, preparing them for leadership roles where structured decision-making is required. Moreover, persistence in solving mathematical problems develops confidence, an attribute highly valuable in professional life.

The integration of mathematics with modern technologies further demonstrates its significance. In engineering, mathematics underpins emerging fields such as artificial intelligence, robotics, renewable energy, and nanotechnology. These fields rely on mathematical algorithms and computational methods to achieve innovation. Business students, meanwhile, face a data-driven world where mathematical tools are used for predictive analytics, customer behavior modeling, and financial risk management. The growing importance of machine learning and big data has blurred the boundaries between business and engineering, making mathematical knowledge a shared asset across both disciplines.

From an academic perspective, mathematics also enhances interdisciplinary learning. Business and engineering students often collaborate on projects that require both technical and managerial expertise. Mathematics serves as the bridge that connects their disciplines, allowing them to communicate effectively and solve problems collectively. For instance, in project management, engineers may design a system while business graduates analyze its market feasibility using statistical models. In this way, mathematics not only strengthens individual competencies but also fosters teamwork across disciplines.

On a broader level, the importance of mathematics extends to societal development and global challenges, which business and engineering graduates are expected to address. Engineers use mathematics to design sustainable technologies that mitigate environmental problems, while business professionals employ mathematical models to

promote efficient resource allocation and sustainable economic growth. Both groups, therefore, contribute to global progress by applying mathematics to solve pressing issues such as climate change, renewable energy, and equitable economic development.

In addition, mathematics enables students to understand and navigate uncertainty. In the business world, markets are unpredictable, and decisions must be made with incomplete information. Probability and statistics provide tools for managing this uncertainty, allowing business leaders to make informed choices even in volatile conditions. Engineers, too, must deal with uncertainty in materials, environmental conditions, and system performance. Mathematical models help them design systems with built-in resilience and reliability. By mastering the mathematics of uncertainty, students gain the ability to thrive in complex, unpredictable environments.

The importance of mathematics is evident in its contribution to academic excellence and professional recognition. Research has shown that students with strong mathematical backgrounds perform better not only in technical courses but also in critical thinking and analytical writing. Employers often view mathematical competence as an indicator of discipline, intelligence, and potential for leadership. For business and engineering graduates, this translates into greater employability, higher salaries, and enhanced opportunities for advancement. In many competitive examinations and professional certifications, mathematics is a core component, reinforcing its value as a gateway to success.

In conclusion, mathematics holds immense importance for business and engineering students because it shapes their intellectual abilities, career competencies, and societal contributions. It is not only a subject to be studied but a lifelong skill that enables precise thinking, effective problem-solving, and innovative design. By mastering mathematics, business students gain the ability to analyze financial data, forecast market trends, and make informed strategic decisions. Engineering students, meanwhile, use mathematics to design systems, simulate processes, and push the boundaries of technology. Together, both disciplines demonstrate that mathematics is a unifying force, essential for personal growth, professional excellence, and societal advancement. For business and engineering students, therefore, mathematics is not just a requirement of their curriculum but a cornerstone of their future success in a complex, interconnected world.

2. Related Literature Review

The study of science in design and business focuses on the fundamental and important step of studying what mathematics is and why we focus on mathematics as an element of learning. Individuals can use science to inform their opinions on concepts such as number, space and time. This is part of science that contributes to achieving fundamental goals.

75 famous American Mathematicians have composed papers making sense of this "to realize Science means to have the option to do Math: to utilize Numerical language with some familiarity, to do issues, to censure contentions, to find confirmations and what might be the main action, to perceive a Numerical idea in, or to extricate it from, a given substantial circumstance." [3].

Science is a mandatory course practically in each field, for example, designing, business and drug store and so on. That's what orton and Car express "a coordinated collection of information, a theoretical arrangement of thoughts, a valuable device, a vital aspect for grasping the world, a perspective, a rational framework, a scholarly test, a language, the most perfect conceivable rationale, a tasteful encounter, a making of the human psyche"[4].

Evaluative Arithmetic is parted into "content areas" and "mental spaces," as per the Patterns in Worldwide Math and Science Study (TIMSS). The Global Relationship for the Assessment of Instructive Execution (2011) offers a significantly more exhaustive system that incorporates his four branches of knowledge - numbers (30%), polynomial math (30%), calculation (20%), and information open doors (20%) - as well as three mental spaces - information (35%), application (40%) and conversation (25%).

As indicated by Draper Science is instructed uniquely in contrast to different subjects. Understudies can become familiar with similar data in various ways, contingent upon the material picked by the educator [5]. Numerous specialists presume that understudies can without much of a stretch foster procedural familiarity with Math however they have dealing with an issue in theoretical information on Mathematics.

Mathematics learning and teaching both is complex. Skemp (1987) stated that Mathematics cannot be learnt from the surroundings, although learnt it indirectly from other Mathematics. He also admitted that learning Mathematics highly dependent on good teaching [6].

Lev Vygotsky (1978) started work on Piaget’s leading theory and give the theory of social constructivism. The basic idea of this theory is the interaction with others that forms the basis for an individual's own understanding of ideas. He also suggests that thoughts are depend on language. Furthermore, in his point of Learning is basically a social process in which information is shared with others and occurs in a social context rather than being initially represented just in the individual's mind. He also presents the concept of the zone of proximal development of the pupil. He divides his thinking into "actual developmental levels determined by independent problem-solving and potential developmental levels determined by problem-solving under adult guidance or in collaboration with more capable peers." It is expressed as "the distance between developmental levels". Vygotsky also emphasizes the teacher's role in Mathematics learning.

He said teachers provide a platform for students to build their study skills. Skills are developed through interaction and teacher guidance [7].

Interdisciplinary Mathematics is a branch of Mathematics that combines expertise in Mathematics with knowledge from another field (usually science, economics, medicine, or engineering). The term interdisciplinary is likely to be used interchangeably with interdisciplinary [8].

Every nation's corporate sector and educational system have an impact on its economic stability. The strength of the national economy is influenced by the quality of education. Mathematics is an essential element at the postsecondary level in business courses. Two courses in the business studies undergraduate program was taught in separate semesters. Basic mathematics is one of them, and inferential statistics is the other. Other business management courses and the business profession are supported by the material covered in basic mathematics courses.

Business organizations use Mathematics in accounting areas such as financial analysis, cost accounting, management accounting, inventor management, corporate accounting, and sales forecasting [9]. Engineering is described by the U.S. Department of Labor as an “application of Mathematics and principles of science to develop economical solution to industrial troubles”. Because mathematical knowledge and skills are recognized as important in engineering curricula, there is little research literature on the types of Mathematics used in engineering. Cardella says that “Although many educators believe that Mathematics is vital for engineering students, there is a belief among some practicing engineers that the Mathematics they learned in college is not related to their daily work” [10].

Attitude is a psychological construct that reflects an individual’s predisposition to respond favorably or unfavorably toward a particular object, concept, person, or situation. It is generally considered a learned tendency that develops through experiences, social influences, and personal beliefs. Attitudes play a vital role in shaping human behavior, decision-making, and performance in both academic and professional contexts. They are multidimensional in nature, typically consisting of three components: the cognitive component (beliefs or knowledge about an object), the affective component (emotions or feelings associated with it), and the behavioral component (the tendency to act in a certain way).

In the educational setting, attitude toward a subject such as mathematics can significantly impact students’ motivation, engagement, and achievement. A positive attitude fosters confidence, persistence, and willingness to engage with challenging tasks, while a negative attitude may lead to avoidance, anxiety, and poor performance. Moreover, attitudes are influenced by teaching strategies, peer interactions, and perceived relevance of the subject to future goals. Therefore, understanding students’ attitudes is crucial for educators and policymakers, as it can guide the development of effective teaching methods, supportive learning environments, and curriculum reforms that promote sustained interest and improved academic outcomes. Finally, it is clear that additional research is needed to establish a more universal definition of attitude, a more accurate method of measurement, and further categorization of experiences which modify attitude in light of the ambiguous findings of previous research on attitudes toward Mathematics. Mathematics is a practical field of study, but learners find it more tedious and unrealistic. An interdisciplinary program in Mathematics makes Mathematics interesting, engaging and meaningful.

The Fennema and Sherman (1976) scale, which is still "very influential" in current research, covers elements including attitudes toward success in Mathematics, confidence in Mathematics, utility of Mathematics, teacher perspectives, Mathematics anxiety, as well as gender roles [11]. Other instruments, like Tapia, have been created based on the Fennema-Sherman scale.

3. Objective of the Study

The point of the review was mentality estimated in mental, emotional and conduct areas for tracking down the variables that influence the learning of Science among business and designing understudies. Speculations and related investigates were utilized for making a survey research instrument.

4. Research Methodology

The exploration approach of this study is a blended technique approach i.e., subjectively and quantitatively both. The number of inhabitants in this review was understudies of private designing colleges and business colleges.

In 1995, Davies highlighted that overarching ideological direction on which the research is based, the method of data collection, the types of data generated, and the method of data analysis also help distinguish the two approaches (Davies, 1995).

In this study we use mixed method research technique. Mixed method research, which combines both qualitative and quantitative approaches, has become increasingly important in contemporary academic and applied studies. Its significance lies in its ability to provide a more comprehensive understanding of complex research problems than either method could achieve alone. By integrating numerical data with contextual insights, mixed methods allow researchers to capture both the breadth and depth of a phenomenon.

One of the primary advantages of mixed method research is its complementarity. Quantitative data can reveal patterns, correlations, and measurable outcomes, while qualitative data provides explanations, perspectives, and deeper meanings

behind those patterns. For example, in education research, surveys may highlight students' achievement levels, while interviews reveal the attitudes, motivations, or challenges that contribute to those outcomes. The integration of these two types of data produces findings that are more robust, valid, and applicable.

Another critical importance of mixed method research is triangulation, which enhances the reliability and credibility of results. By cross-verifying findings through multiple approaches, researchers minimize biases and strengthen the validity of their interpretations. This is particularly valuable in fields such as social sciences, health, and education, where human behavior and experiences are multifaceted.

Moreover, mixed methods provide flexibility and adaptability. Researchers can design studies that address both general trends and specific individual cases, making the results more relevant for policymakers, practitioners, and stakeholders. The combination of statistical generalizability and narrative richness ensures that decisions based on research are both evidence-driven and contextually grounded.

In conclusion, mixed method research is important because it bridges the gap between numbers and narratives. It provides a holistic perspective, ensures rigor and validity, and produces actionable knowledge that is better suited to address real-world complexities.

4.1 Mathematics Learning Affect with Attitude

Tables 1 and tables 2 are addresses the aftereffects of members who fill the total survey. Table's shows mean, standard deviation, Cronbach's alpha and over all mean per scale. The information isolated into four degrees of perspectives: exceptionally certain, positive, modestly and negative.

Table 1. Attitudes towards Calculus

Scale	–	–		Mean/Scale
Usefulness	44.68	7.09	0.82	3.6
Self-efficiency	44.22	9.66	0.90	3.8
Motivation	43.70	6.54	0.85	3.7
Anxiety	35.64	12.56	0.98	3.1
Learning Habit	45.58	7.60	0.77	3.8

Table 2. Attitudes towards Business Mathematics

Scale	–	–		Mean/Scale
Usefulness	46.19	6.66	0.81	3.9
Self-efficiency	43.60	6.19	0.71	3.7
Motivation	45.70	6.03	0.60	3.5
Anxiety	38.49	7.96	0.63	3.3
Learning Habit	42.13	8.12	0.80	3.6

A most elevated implies shows that the understudies were more certain. Understudies' mental index scored low side and full of feeling inventory on the most noteworthy side. This distinguishes that understudies' responded good towards Science courses however didn't feel sure with their Math abilities and not think about valuable in their lives.

4.2 Gender Difference in Attitudes towards Mathematics

In table 3 and figure 1 shows gender difference in attitude among engineering students. Further, table 4 and figure 2 shows gender difference in attitude among business students. A significant contrast affirmed in people demeanor towards Science courses. The demeanor of ladies is positive moderately men when we look at the mean of every area in both engineering and business students.

Table 3. Gender Difference in attitudes towards Calculus (Engineering Students)

Men			Women				
Dependent Variable	–	–	–	–	F	P	2
Usefulness	42.14	7.41	44.67	7.02	9.84	0.012	0.421
Self-Sufficiency	45.00	9.62	48.05	8.10	0.78	0.356	0.103
Motivation	42.96	8.29	47.22	7.89	6.10	0.005	0.120
Anxiety	37.66	10.39	36.94	13.37	0.43	0.729	0.001
Learning Habit	46.49	7.61	46.76	6.02	2.66	0.433	0.009

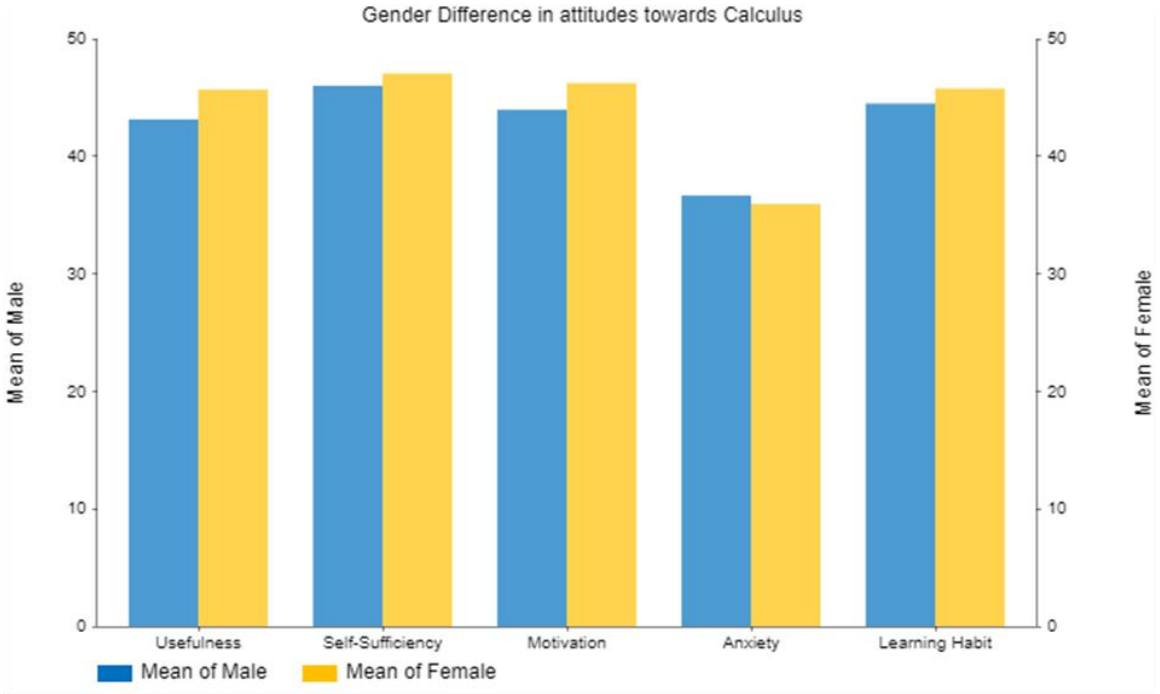

Figure 1. Gender Difference in attitudes towards Calculus (Engineering Students)

Table 4. Gender Difference in attitudes towards Business Mathematics

Men				Women			
Dependent Variable	–	–	–	–	F	p	2
Usefulness	46.32	7.82	45.52	6.30	1.00	0.37	0.003
Self-Sufficiency	43.94	7.19	42.47	6.92	3.08	0.09	0.006
Motivation	46.73	6.83	45.92	7.15	1.00	0.30	0.004

Anxiety	38.57	9.92	38.04	8.21	0.10	0.76	0.005
Learning Habit	44.69	8.10	39.21	7.50	5.30	1.07	0.033

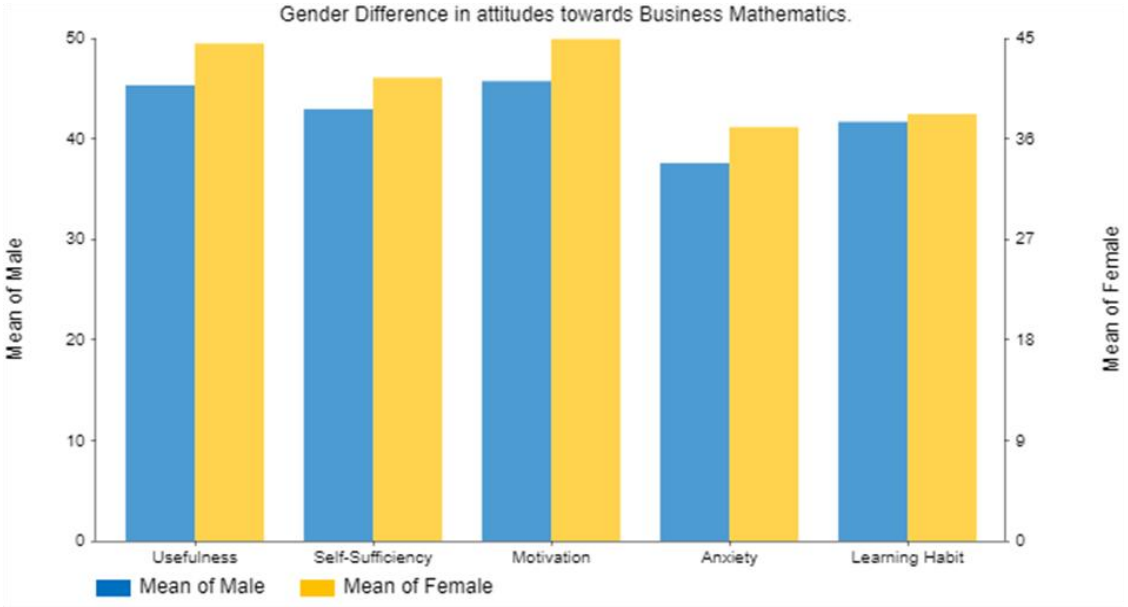

Figure 2. Gender Difference in attitudes towards Business Mathematics

5. Conclusion

The finding of this exploration is useful for development of Arithmetic educating and learning in the two callings. In further, this study is likewise being advantageous for organization. The aftereffects of this reviews shows that understudies disposition impact on their Science learning, great numerical abilities made their expert process simple and mentality of both orientations additionally unique towards Math courses. The reconciliation of innovation additionally made instructing and picking up fascinating.

Finally, the numerical abilities are utilized in proficient designing field and the business world according to their need.

In last, if students have positive attitude towards Mathematics they will perform better in exams. The results of this study may help other researchers, faculty members and administrators. By successfully guiding students through their Mathematics classes and degree programs, we may give them a better chance to thrive in the modern, global workforce.

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