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Economics Students' Attitudes Towards Mathematics

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Abstract

The quantitative nature of economics needs a strong understanding of mathematics. Mathematics is essential for analyzing markets, interpreting data, forecasting trends, testing economic theories, and informing decisions in financial investments and business strategies. This study synthesizes the attitudes of economics students towards mathematics, a critical factor influencing academic achievement and career success. Using a theoretical framework i.e. Katz's functional theory of attitude formation and the ABC model, this study defines student attitudes as a complex interplay of emotional responses, behaviors, and beliefs. The review highlights the foundational role of mathematics in economics, from basic algebra to advanced econometrics, and explores the key factors shaping students' attitudes. It identifies perceived relevance, mathematics anxiety, self-efficacy, and pedagogical methods as primary influencers. This study discusses the significant impact of these attitudes on academic performance and future career trajectories, noting that negative pedagogical interventions, including emphasizing real-world applications, implementing active learning strategies, and explicitly addressing mathematics anxiety, can foster positive attitudes and better prepare students for the demands of a modern, data-driven economy.

***Keywords*:** economics education, mathematics attitude, mathematics anxiety, pedagogical interventions, quantitative skills, student self-efficacy

Introduction

At its foundation, economics is a highly quantitative field that models, analyzes, and interprets complex phenomena primarily using mathematical concepts. From macroeconomic policy implications to microeconomic supply and demand dynamics, mathematics is a vital tool for comprehending basic economic concepts (Georgiyevna, 2019). Market analysis, data interpretation, trend forecasting, testing economic theories, and guiding financial investment and business strategy decisions all depend on it. Beyond scholarly comprehension, mathematical proficiency is acknowledged as essential to a society's economic prosperity. On the other hand, it is thought that a major barrier to achieving economic and social development at both personal and national levels is a lack of competence in STEM (science, technology, engineering, and mathematics) fields, especially in mathematics (Galloway, 2023; Georgiyevna, 2019). Beyond academic ability, mathematics plays a fundamental role in economics, directly affecting both a society's economic prosperity and individuals' career paths (Bulut, 2025; Dimakou, 2020). Therefore, understanding and addressing students' attitudes toward mathematics becomes even more important, going beyond academic success to include broader societal and personal well-being.

Students' feelings about math are complex and have a big effect on how well they do in school and how much they enjoy it. These attitudes include whether a student likes or dislikes the subject, whether they tend to do or avoid math activities, and what they think about their own abilities or the subject's usefulness (Lambert et al., 2022; Mabena et al., 2021). Although students may initially demonstrate favorable attitudes towards mathematics, this inclination frequently wanes as they advance to higher educational tiers (Lugosi et al., 2022). This trend suggests that current teaching methods may not be working as well as they should. The decline may be due to students not being able to adapt to the increasing complexity and abstraction of advanced math concepts, or to not seeing how these concepts remain important. This phenomenon is especially critical for economics students, whose curriculum progressively incorporates more sophisticated mathematical frameworks.

This study integrates existing research regarding economics students' attitudes toward mathematics. It examines the theoretical basis of how attitudes form, identifies the key factors that shape them, examines how these attitudes affect academic performance and career paths, and discusses effective teaching methods. Additionally, it examines cross-cultural differences in attitudes toward mathematics, seeking to provide a comprehensive understanding that can enhance educational methodologies and guide subsequent research in this essential domain.

Methods of Study

This study was done by systematically searching for and analyzing academic and peer-reviewed articles and conference papers. The search strategy concentrated on pivotal terms including "economics students' attitudes towards mathematics," "mathematics anxiety in economics," "quantitative skills in economics education," and "pedagogical interventions for mathematics in economics." We used databases like JSTOR, Scopus, Google Scholar, and university library catalogs to find the right books and articles. The selection criteria encompassed studies that were empirical, theoretical, or review-based, published predominantly within the last twenty years, and directly examined the correlation between mathematics and economics education. The identified literature was then classified thematically to allow us to create a comprehensive story about theoretical frameworks of attitude, the art of mathematics in economics, factors affecting student attitudes and their implications, and teaching strategies. Therefore, this methodology seeks to provide an exhaustive and up-to-date overview of existing knowledge on this crucial subject.

Review of Related Literatures

Defining Students' Attitudes Towards Mathematics

To appreciate the complex nature of students' attitudes towards mathematics, we must turn our attention to psychological theories that explain how attitudes are formed and expressed. A framework like this is not going to capture the psychological background of a student that leads them to be successful or unsuccessful in learning mathematics; however, it provides particulars for looking at specific resilience and capabilities, beliefs, affect, and identity from an analytical perspective.

Theoretical Framework

Functional Theory of Attitude Formation (FTAF)

It explains that individuals hold attitudes because they serve psychological functions. Katz identified four primary functions:

Instrumental or Utilitarian Function: Attitudes are developed to maximize rewards and avoid punishments. A student develops a positive attitude towards mathematics if they realize that it can serve them for personal ends, such as career development, or improve their living standard. A negative attitude, however, will be developed if mathematics is viewed as useless or painful. For economics students, the function is particularly appropriate because they view mathematics as a means to an end – a tool for their ultimate professional application in finance, statistics, or policy. Unless the utility of the teaching is made clear, their interest can easily wear off (Katz, 1960; Primandari et al., 2024).

Knowledge Function: Attitudes help individuals organize and make sense of the world around them, providing a safe ground for understanding events. This is a function sought out of curiosity, in intrinsic interest to know, rather than bare necessity. For economics students, a positive attitude toward the knowledge function might be the result of a genuine desire to understand how mathematical models explain economic phenomena, for instance, the workings of game theory or the mechanisms in economic growth models (Katz, 1960).

Value-Expressive Function: Attitudes reflect an individual's underlying values and self-conception, which help build self-identity. For instance, a person can adopt a subject if it is consonant with their self-perception or membership in groups. A student of economics who identifies himself or herself as a "problem-solver" or "analytical thinker" will have a positive attitude towards mathematics because it validates this view of self (Katz, 1960; Lambert et al., 2022).

Ego-Defensive Function: Attitudes serve as ego defense mechanisms that shield people from hurt or uncomfortable truths. Denial, repression, projection, or rationalization usually occur when confronted with ideas that contradict internal values or convictions. For example, a poor math student may assume an unfavorable, ego-defensive attitude justifying mathematics as "too abstract" or "irrelevant" to their future career, thereby shielding their self-esteem from perceived failure (Rind & Technologies, 2021).

Katz's Functional Theory of Attitude Formation presents a solid model for understanding the origins of specific attitudes among economics students. Since such students encounter mathematics in its instrumental or utilitarian guise, recognizing it as a tool for their working lives in the future, its failure to evidently demonstrate its relevance as instruction can promptly erase their interest and motivation. This can, however, lead to ego-defensive attitudes when presented with abstract or challenging mathematical content that lacks an explicit connection to their economic studies or future career goals.

ABC (Affective, Behavioral, Cognitive) Model

This highly respected model posits that attitude is comprised of three related elements:

Affective Component: Refers to the emotional response or affect towards mathematics (e.g., enjoyment, dislike, liking, apprehension). This component captures the emotional tone of a student's experience with mathematics. For economics students, this might involve feeling elation in successfully solving an optimization model or irritation in failing with complex econometric models (Ajzen, 1993).

Behavioral Component: Comprises the tendencies or inclinations to act in certain ways towards mathematics (e.g., doing mathematical exercises, avoiding them, seeking assistance, or postponing mathematics tasks). This refers to observable action or tendencies. A favorable behavioral component in an economics student would engage in quantitative tutorials, while an unfavorable one would avoid math-intensive subjects (Ajzen, 1993).

Cognitive Component: Describes the beliefs, ideas, and perceptions about mathematics (e.g., usefulness, difficulty, or ability, or sometimes referred to as self-efficacy). This refers to the intellectual and information component of attitude. For economics students, this may include beliefs about whether calculus is actually needed to understand macroeconomic models, or whether they are "bad at math" (Ajzen, 1993).

The three-dimensionality of attitude as outlined in the ABC model necessitates comprehensive interventions. Intervening on mathematics anxiety in isolation, while ignoring students' perceptions of the subject's use value, or vice versa, might not be enough. For economics students, perceived usefulness is particularly important given the applied nature of the discipline. Interventions, therefore, must address all three aspects to foster an all-encompassing positive attitude (Ajzen, 1993; O'Connell, 2018).

Walberg's Theory of Productivity

The theory is typically applied to account for the numerous factors that influence a student's enjoyment or lack thereof of mathematics. It considers instructional, psychological, and environmental determinants of success, such as attitudes. Walberg's model suggests that learning is a function of nine multiplying factors: student ability, age, motivation, instruction, amount of instruction, home environment, peer group, classroom climate, and media. When used to refer to mathematical attitudes in economics, the model suggests that a student's attitude towards mathematics is not a uniquely individual attribute but is influenced significantly by the quality of teaching, the support received at home, peer attitudes, and the classroom climate (Walberg et al., 1986). For instance, a supportive classroom environment in which mistakes are seen as opportunities for learning can significantly reduce math anxiety and cultivate positive attitudes, even for students who have had negative past experiences.

These conceptual models constitute a core framework for studying students' attitudes towards mathematics, particularly in the context of teaching economics. They place special emphasis on the fact that attitudes are dynamic constructs, not static states, and are formed by a complex set of internal and external factors.

Components of Mathematics Attitude

When researchers investigate student attitudes towards mathematics, they typically focus on several key aspects, which align with the ABC model

Liking or Disliking the Subject

This is the primary affective component, reflecting a student's emotional disposition towards mathematics. It's a direct measure of how much pleasure or displeasure a student associates with engaging in mathematical tasks (Tarmizi et al., 2010).

Tendency to Engage in or Avoid Mathematical Activities

This behavioral component indicates a student's willingness to participate in math-related tasks or their inclination to shy away from them. This can manifest as active participation in class, voluntary engagement with challenging problems, or, conversely, procrastination and selection of less quantitative courses (Fernandes & Vale, 2022).

Belief in One's Own Ability (Self-Confidence/Self-Efficacy)

A cognitive component, this refers to a student's self-efficacy in mathematics, or their conviction in their capacity to solve mathematical problems and succeed in math-related tasks. High self-efficacy is strongly linked to persistence and better performance (Ezeudu et al., 2020; Waddington, 2023). For economics students, this translates to confidence in their ability to understand and apply complex economic models that rely on mathematical reasoning.

Perception of the Usefulness of Mathematics

Another crucial cognitive component, this reflects a student's belief in the practical value and relevance of mathematics to their life, studies, and future career. Students who perceive mathematics as useful are more likely to invest effort and maintain positive attitudes, especially in applied fields like economics (Ezeudu et al., 2020; Mzomwe, 2018).

Mathematics Anxiety

A specific affective response characterized by feelings of tension, apprehension, or fear that can interfere with mathematical performance. It's a debilitating emotional state that can lead to avoidance behaviors and reduced cognitive processing capacity during mathematical tasks (Choe et al., 2019).

Mathematics Enjoyment

The positive emotional experience derived from engaging with mathematics. This is distinct from simply not disliking it; it implies a genuine pleasure and satisfaction from working with mathematical concepts (Greensfeld & Deutsch, 2022).

Intrinsic Motivation

The drive to engage with mathematics for its own sake, driven by curiosity, challenge, and a desire to comprehend, rather than external rewards or pressures. Intrinsically motivated students are more likely to delve deeper into mathematical concepts and persist through difficulties (Opstad, 2019; Poesia et al., 2024).

These components are interrelated, and their collective assessment provides a holistic picture of a student's overall attitude towards mathematics. Understanding these individual facets allows educators to design targeted interventions that address specific areas of concern, rather than applying a one-size-fits-all approach. For instance, an intervention aimed at reducing anxiety might differ significantly from one focused on enhancing the perceived usefulness of mathematics.

The Interplay of Mathematics and Economics

The relationship between mathematics and economics is profound and increasingly integral, shaping the academic demands and career trajectories for students in the field. Economics is widely acknowledged as the most quantitative among the social sciences. Students pursuing economics degrees are expected to possess and develop robust mathematical skills to analyze economic phenomena effectively. This includes the ability to graph and solve algebraic functions, interpret complex graphs, and utilize formulas and equations to understand intricate economic interactions (Arsaythamby & Julinamary, 2015).

Mathematical Foundations Required for Economics Degrees

The core mathematical skills essential for economics students span several domains, each building upon the last and becoming increasingly sophisticated as students advance in their studies:

Algebra

This is the foundational mathematical language for economics. It is used to solve economic equations, analyze functions, and understand fundamental economic and mathematical models, such as supply and demand. Algebra helps calculate total cost, revenue, and equilibrium points in economic models

Calculus

Crucial for optimization problems, analyzing economic functions, and conducting marginal analysis. In microeconomics, calculus is used to find the profit-maximizing output for a firm by setting the derivative of the profit function to zero (marginal revenue equals marginal cost). In macroeconomics, calculus can determine changes in national income due to fiscal policy shifts or model the rate of economic growth. Concepts like derivatives, integrals, and optimization are indispensable for understanding dynamic economic behavior and decision-making under constraints (Yaqin, 2025).

Statistics

An integral part of economics, used to interpret data, forecast trends, and apply probability models. University-level economics programs emphasize statistical analysis and regression models to measure economic activity, test hypotheses, and evaluate policy effectiveness. Students learn to analyze data on unemployment rates, inflation, GDP, and consumer behavior, using statistical tools to draw meaningful conclusions (Akomodi, 2025).

Linear Algebra

Essential for economic modeling, handling matrix equations, and various business applications. It is particularly relevant for understanding general equilibrium models, input-output analysis, and multi-variable optimization problems. For instance, solving systems of linear equations is fundamental to understanding how different sectors of an economy interact (Simon & Blume, 1994).

Econometrics

A specialized field that combines mathematical models with economic theory, utilizing statistical modeling, hypothesis testing, and regression analysis to analyze real-world economic data. Econometrics allows economists to quantify relationships between economic variables, forecast future trends, and evaluate the impact of policies. This field heavily relies on a strong understanding of statistics, linear algebra, and calculus to build and interpret complex models (Wooldridge, 2019).

Importance of Quantitative Skills for Economic Analysis and Success

A strong aptitude in mathematics is consistently correlated with higher performance in economics. The application of mathematical precision in economics is not merely an academic exercise; it directly contributes to the formulation of stronger policy recommendations and more effective economic outcomes (Georgiyevna, 2019).

It has been observed that specific mathematical abilities may correlate differently with economic performance. For example, some studies have found that Geometry EOCT scores were more strongly correlated with Economics EOCT performance than with Algebra EOCT performance (Awoniyi et al., 2025; Galloway, 2023). Similarly, calculus grades have been positively associated with performance in Intermediate Microeconomic Theory (Mallick & Agarwal, 2019). The observed nuanced correlation between distinct mathematical skills, such as geometry and algebra, and performance in economics indicates that a broad assessment of "math proficiency" may not adequately predict student success or guide the provision of tailored support for economics students. This suggests that the specific forms of mathematical reasoning cultivated by various mathematics courses, encompassing spatial, logical, and analytical thinking, could be more significant than mere computational aptitude for success in economics. For instance, the ability to visualize economic relationships graphically (often associated with geometry) can be as crucial as solving equations (algebra) for understanding complex economic models.

Challenges of Mathematical Rigor in Economics

Despite the undeniable importance of mathematics in economics, the increasing mathematical rigor presents several challenges for students. One significant challenge is the abstractness of advanced mathematical concepts when not immediately tied to tangible economic applications. Students often struggle to see the relevance of abstract mathematical tools, leading to disengagement and a perception of mathematics as an arbitrary hurdle rather than a useful instrument (Benítez & Parra, 2024).

Another challenge is the transition from high school mathematics to university-level mathematics in economics. The pace and depth of mathematical instruction in economics programs can be overwhelming for students who may have had a less rigorous mathematical background or who are not accustomed to the level of independent problem-solving required (Asian Chaves et al., 2022). This gap can lead to feelings of inadequacy and contribute to mathematics anxiety.

Furthermore, the interdisciplinary nature of economics means students must not only master mathematical tools but also effectively integrate them with economic theory. This requires a different kind of cognitive flexibility, moving between abstract mathematical reasoning and concrete economic interpretation. Students may be proficient in solving mathematical problems in isolation but struggle to apply these solutions to real-world economic scenarios or to articulate the economic implications of their mathematical findings (O’Connell, 2018). These challenges underscore the need for thoughtful curriculum design and pedagogical approaches that explicitly bridge the gap between abstract mathematics and its practical application in economics.

Results and Discussion

Factors Influencing Economics Students' Attitudes Towards Mathematics

Student attitudes towards mathematics are shaped by a complex interplay of individual perceptions, psychological states, pedagogical approaches, and broader socio-cultural influences. Understanding these factors is crucial for developing effective strategies to foster positive attitudes among economics students.

Perceived Relevance and Usefulness of Mathematics

The perceived relevance of mathematics is the most influential factor in shaping students' attitudes. Students are significantly more inclined to develop positive attitudes when they can clearly discern the practical value and tangible applications of mathematical concepts in their coursework, daily lives, and future career aspirations (Galloway, 2023; Laging & Voßkamp, 2017). Conversely, if mathematics instruction fails to explicitly integrate real-world examples, students may dismiss certain topics as irrelevant, leading to disengagement and a decline in positive attitudes. This phenomenon is particularly pronounced in students enrolled in "practical-oriented programs," such as economics, who often perceive mathematics primarily as a tool rather than a subject of intrinsic interest (Katz, 1960).

The consistent emphasis on perceived relevance indicates that for economics students, even abstract mathematical rigor, though essential, must be perpetually contextualized within economic applications. A failure to establish this connection can rapidly diminish student motivation, irrespective of students' intellectual understanding of the necessity of mathematics. For example, teaching derivatives without illustrating their use in marginal analysis for cost minimization or profit maximization in a business context can lead economics students to question the utility of such concepts, thereby eroding their interest and engagement. Research by Ezeudu et al. (2020) shows that students' perceptions of the utility of mathematics are strong predictors of their engagement and persistence in quantitative fields. Therefore, educators must consistently bridge the gap between abstract mathematical theory and its concrete economic applications to foster and maintain positive attitudes.

Mathematics Anxiety and Self-Efficacy

Mathematics anxiety is a significant psychological barrier contributing to students' aversion to mathematics. It is characterized by feelings of tension, apprehension, or fear that directly interfere with mathematical performance (Choe et al., 2019). This anxiety can negatively impact a student's confidence and willingness to participate in math-related tasks, leading to avoidance behaviors. Importantly, mathematics anxiety is not exclusively tied to low mathematical abilities; it is also reported by students who possess robust mathematical backgrounds but still experience debilitating fear when confronted with mathematical challenges (Galloway, 2023; Lambert et al., 2022).

The presence of mathematics anxiety can severely impair working memory, thereby hindering performance and leading to avoidance behaviors and reduced self-efficacy. This often creates a detrimental cycle of underperformance or even failure (Laging & Voßkamp, 2017). Research indicates inverse relationships between mathematics anxiety and mathematics self-efficacy (a student's confidence in their ability to solve math problems) and between mathematics anxiety and expected grades (Galloway, 2023; Waddington, 2023). Conversely, high self-efficacy has been shown to help students cope with mathematics anxiety and improve performance (Ezeudu et al., 2020; Simon & Blume, 1994). The prevalence of mathematics anxiety among economics students is notable. It is considered an inherent aspect of the overall attitude towards mathematics and directly impacts learning performance. The observation that mathematics anxiety impacts even students with strong mathematical abilities and is widespread among economics students implies that mere enhancement of mathematical skills may be insufficient. Effective interventions must specifically address the psychological dimensions of anxiety and self-efficacy, potentially through metacognitive approaches or by cultivating a growth mindset (Greensfeld & Deutsch, 2022).

Impact of Learning Environment and Teaching Methods

The learning environment and the pedagogical methods employed by instructors play a pivotal role in shaping student attitudes and academic achievement. Traditional, teacher-centered instructional approaches, often described as "chalk and talk," can lead to passive learning experiences and inadvertently deepen students' aversion to mathematics, particularly if the focus is solely on abstract procedures without context (Ezeudu et al., 2020; Katz, 1960). In contrast, effective lessons portray mathematics as a dynamic body of knowledge, actively guiding students in establishing real-world connections and engaging them in the learning process (O’Connell, 2018).

The learning environment and pedagogical methods function as more than mere conduits for knowledge; they actively mold student attitudes. A passive, abstract learning setting, even when delivering high-quality content, can unintentionally cultivate negative attitudes, especially for economics students who thrive when mathematics is presented as a dynamic, applied discipline. Research suggests that an instructor's enthusiasm, clarity, and willingness to connect mathematics to economic concepts significantly influence student engagement and attitudes (Benítez & Parra, 2024). Furthermore, a supportive classroom climate in which students feel safe asking questions, making mistakes, and collaborating with peers can significantly reduce anxiety and foster a more positive disposition towards mathematics (Dagume & Khangale, 2023; O’Hara et al., 2022). The integration of technology, such as statistical software or simulation tools, can also make the learning process more interactive and visually engaging, thereby improving attitudes (Saha et al., 2020).

Influence of Prior Experiences, Aptitude, and Motivation

A student's past experiences with mathematics are a significant determinant of their current attitude; negative prior experiences are notable contributors to dislike of and anxiety about mathematics (Choe et al., 2019; Lambert et al., 2022). These early experiences, often in primary or secondary education, can shape a student's fundamental beliefs about their mathematical ability and the nature of mathematics itself. If these experiences were characterized by struggle, pressure, or a lack of understanding, they can create a lasting aversion that is difficult to overcome in higher education.

Individual aptitude attributes, including self-confidence, anxiety levels, enjoyment of the subject, perceived usefulness, and intrinsic motivation, all influence a student's overall disposition towards mathematics (Poesia et al., 2024). Notably, intrinsic motivation, the drive to engage with mathematics for its own sake, driven by curiosity and a desire to comprehend, has been identified as a factor capable of compensating for a lack of adequate prior training in mathematics(Ezeudu et al., 2020). Students who are intrinsically motivated are more likely to persist through challenges and seek deeper understanding, even if they initially struggle with certain concepts.

Beyond individual factors, external influences also play a crucial role. Parental influence, particularly parental mathematics anxiety, can be unintentionally transmitted to children, affecting their attitudes and performance (Maloney et al., 2015). Furthermore, undue parental or teacher pressure to master complex mathematical topics, such as calculus or geometry, can negatively affect students' attitudes by increasing stress and reducing intrinsic motivation. Socio-economic status and the level of parental support have also been found to be significant predictors of student attitude and achievement in economics, with students from higher socio-economic backgrounds often having access to better resources and support systems that foster positive attitudes towards academic subjects, including mathematics (Galloway, 2023). The cumulative impact of adverse prior experiences, parental influences, and socio-economic factors on attitudes toward mathematics indicates that addressing these attitudes requires a holistic, sustained approach that extends beyond the confines of the classroom. For economics students, this implies acknowledging that their mathematical groundwork and emotional connection to mathematics are largely formed well before their enrollment in a university economics program.

Impact of Attitudes on Academic Performance and Career Paths

The attitudes economics students hold towards mathematics are not merely subjective preferences; they exert a tangible influence on their academic performance and, consequently, their future career trajectories.

Correlation Between Mathematics Attitude and Academic Achievement in Economics

A consistent and significant positive correlation has been observed between students' attitudes towards mathematics and their academic performance in the subject itself (Arsaythamby & Julinamary, 2015; Opstad, 2019). This relationship is often characterized as moderate to strong, indicating a meaningful link between a student's disposition and their scholastic outcomes. Positive attitudes are shown to fuel robust academic performance, whereas negative attitudes can lead to weaker results. Specifically, enjoyment of mathematics and a general positive attitude are significant predictors of student performance (Awoniyi et al., 2025; Tarmizi et al., 2010).

When considering the direct link to economics, research has revealed a significant inverse association between students' perception of mathematics and their performance in economics (Galloway, 2023). This finding suggests that students who find mathematics challenging or hold a negative perception of it might still achieve good results in economics, possibly by exerting greater effort or employing compensatory learning strategies. However, this success may come at a psychological cost, potentially leading to a diminished underlying attitude towards mathematics within the economics context for some individuals. Conversely, a student's actual performance in mathematics has a positive impact on their performance in economics. Interestingly, some studies have noted that students who gained significant economics knowledge sometimes developed a more negative attitude towards the subject, which could indicate a realization of the subject's inherent difficulty or a trade-off between conceptual mastery and affective experience (Galloway, 2023). This highlights the complexity of the relationship, suggesting that while mathematical proficiency is crucial for understanding economics, the process of acquiring that proficiency can sometimes be emotionally taxing.

Long-Term Implications for Career Choices and Success

The implications of students' attitudes towards mathematics extend far beyond their academic grades, influencing their long-term career choices and the broader economic landscape. Negative attitudes, particularly those associated with mathematics anxiety, are consistently linked to lower mathematics achievement and a pronounced tendency to avoid college mathematics courses, majors, or entire career paths that require quantitative skills (Galloway, 2023). This avoidance behavior can significantly hinder individuals' career progression, potentially limiting their access to lucrative, in-demand professions such as financial analysts, data scientists, econometricians, quantitative researchers, and policy analysts. These roles are increasingly critical in a data-driven global economy.

From a macro-economic perspective, this trend poses a considerable challenge, as the global demand for STEM professionals, including those in quantitatively intensive economics roles, continues to escalate. The enduring consequences of negative attitudes towards mathematics extend beyond individual academic results, affecting national economic competitiveness. Should economics students eschew quantitatively intensive career trajectories due to mathematics anxiety or unfavorable dispositions, a critical talent deficit could emerge in sectors reliant on economic analysis and quantitative expertise. Conversely, students who cultivate positive attitudes towards mathematics are more likely to pursue careers in fields that demand strong mathematical skills, such as finance, accounting, or data analysis, thereby enhancing their professional opportunities. Proficiency in quantitative skills is not only associated with improved job performance but also linked to higher remuneration and overall well-being (Guzmán et al., 2021; Li et al., 2021). The ability to analyze data, build models, and interpret complex quantitative information is now a core competency across a vast array of industries, making a positive attitude towards mathematics an economic imperative.

Challenges Arising from Negative Attitudes

The quantitative nature of economics presents unique challenges for students grappling with low mathematical skills, weak mathematical backgrounds, or mathematics anxiety. Such students often find the subject intimidating, perceiving it as a significant impediment to their learning (Choe et al., 2019). The intimidating character of quantitative economics represents not merely a skill deficiency but also a significant psychological barrier. This suggests that even when students possess the inherent capacity for mathematical comprehension, their negative attitudes can impede effective engagement, culminating in suboptimal academic performance. This can lead to a vicious cycle where poor performance reinforces negative attitudes, further hindering learning.

The persistent issue of poor performance in mathematics, partly driven by negative attitudes, raises broader concerns about the education system's capacity to produce graduates equipped with the essential skills required for an ever-evolving technological society. Specific challenges identified in the literature include accommodating students with diverse levels of mathematical ability, addressing the scarcity of qualified teachers proficient in both mathematics and economics, overcoming the perceived lack of real-world applications in instruction, and adapting to the increasing integration of technology in learning (Greensfeld & Deutsch, 2022; O'Connell, 2018). These challenges underscore the need for targeted and multifaceted interventions to support economics students effectively, ensuring they not only acquire the necessary mathematical skills but also develop a positive and resilient attitude towards their application in economic contexts.

Pedagogical Strategies and Interventions to Foster Positive Attitudes

To counter negative attitudes and promote a more positive disposition towards mathematics among economics students, the literature identifies various pedagogical strategies and interventions. These approaches focus on making mathematics more relevant, engaging, and less intimidating.

Highlighting Real-World Applications and Relevance

A fundamental strategy is for educators to consistently emphasize the practical value of mathematics in their instruction. When mathematical concepts are integrated into practical subjects or presented within authentic contexts, students' confidence and interest significantly improve (Huang et al., 2020; Kihwele & Mkomwa, 2023). This approach helps students recognize the inherent value of learning mathematical concepts, enhances their capacity to retain information, and facilitates cognitive access to the material's meaning. Such contextualization is particularly effective when the examples resonate with students' existing experiences and interests.

For economics students, this translates to transcending generalized "real-world examples" and instead, explicitly and consistently integrating economic applications of mathematics. This represents a fundamental pedagogical reorientation, rather than a mere teaching suggestion, to align with the instrumental function of attitude(Katz, 1960), particularly relevant for economics students. For instance, when teaching derivatives, instructors should immediately illustrate their use in calculating marginal costs, revenues, and profits, or in determining optimal economic policies. Similarly, linear algebra can be introduced through the lens of input-output models or general equilibrium analysis. Project-based learning (PBL) is a particularly effective pedagogical approach in this regard. It transforms negative attitudes toward mathematics by making it more relevant and enjoyable, while simultaneously fostering critical skills such as problem-solving, critical thinking, and collaboration (Lazic et al., 2021). By working on projects that mirror real-world economic challenges, students can directly experience the utility of mathematical tools, thereby reinforcing positive attitudes and deepening their understanding.

Implementing Active Learning and Problem-Based Learning Approaches

Active learning and problem-based learning contribute not only to enhanced cognitive outcomes but also to a transformation of the affective dimension of attitude. By enabling students to actively engage with mathematics and learn from errors in a supportive environment, these methods can effectively counteract the apprehension and passivity frequently associated with conventional mathematics instruction. PBL, in particular, has been shown to promote deeper comprehension and long-term retention of mathematical concepts by requiring students to apply knowledge in authentic contexts (Tarmizi et al., 2010). For economics students, this means engaging them in solving complex economic problems using mathematical tools, rather than simply presenting theories and equations. This hands-on approach can demystify mathematics and make it more accessible and enjoyable for their economic studies.

Addressing Mathematics Anxiety and Building Self-Confidence

Addressing mathematics anxiety is a prerequisite for effective learning, rather than merely a beneficial consequence. The adverse effect of anxiety on working memory indicates that even meticulously crafted pedagogical strategies will yield suboptimal results if the underlying anxiety remains unaddressed. For economics students, this underscores the need to implement explicit strategies to cultivate self-efficacy alongside content instruction.

Creating classroom environments that prioritize physical, emotional, and identity safety, foster positive relationships, and instill a sense of belonging, purpose, and affirmation can significantly help in alleviating mathematics anxiety (O'Hara et al., 2022; Poesia et al., 2024; Tarmizi et al., 2010). Providing positive, interactive, and constructive feedback is also vital, as it helps students recognize their progress and become aware of their mathematical abilities. Encouraging a growth mindset, the belief that intelligence and abilities can be developed through effort, and acknowledging effort, even in the face of mistakes, can substantially improve students' attitudes and motivation. This involves shifting the focus from innate talent to the process of learning and improvement. Instructors can also employ strategies such as breaking down complex problems into smaller, manageable steps, providing ample practice opportunities, and offering alternative methods for solving problems to cater to diverse learning styles. Techniques like journaling about math anxiety or guided relaxation exercises before exams can also be beneficial (Shayer, 2024).

The Role of Teacher Practices and Curriculum Design

Teachers are central to shaping the daily learning conditions students experience, influencing attitudes through their interpersonal relationships, instructional methods, and the overall classroom atmosphere. Effective teacher practices include demonstrating enthusiasm for mathematics, clearly articulating its relevance to economics, and being approachable and supportive. Teachers who possess a strong understanding of both mathematics and economics are better equipped to bridge the disciplinary gap and make the connections explicit for students (O'Hara et al., 2022). Professional development programs that focus on integrating quantitative methods into economics teaching can significantly enhance instructors' ability to foster positive student attitudes.

Curriculum design also plays a critical role. Curricula should be designed to gradually introduce mathematical concepts, ensuring that students have a solid foundation before moving to more advanced topics. The sequencing of courses should reflect the increasing mathematical demands of economics, perhaps including dedicated "math for economists" courses or modules that explicitly link mathematical tools to economic theory (Kihwele & Mkomwa, 2023). Furthermore, curricula should emphasize problem-solving and critical thinking over rote memorization, enabling students to develop a deeper, more meaningful understanding of the material. Integrating case studies and real-world data analysis throughout the curriculum can reinforce the perceived relevance of mathematics (Ezeudu et al., 2020; Kihwele & Mkomwa, 2023).

Technology Integration

The strategic integration of educational technology can significantly enhance the learning experience and positively influence students' attitudes towards mathematics in economics (Jamil et al., 2021). Software packages like R, Python, Stata, EViews, or MATLAB allow students to perform complex calculations, analyze large datasets, and visualize economic models without getting bogged down in tedious manual computations. This can reduce the perceived difficulty of mathematics and make the process more engaging. Online learning platforms, interactive simulations, and educational apps can provide personalized learning experiences, immediate feedback, and opportunities for self-paced learning, catering to diverse student needs and learning styles. For instance, using simulation tools to model market dynamics or macroeconomic policies can make abstract economic concepts more tangible and demonstrate the power of mathematical modeling in a dynamic way. However, it's crucial that technology is used as a tool to enhance understanding, not as a replacement for conceptual comprehension. The focus should remain on teaching the underlying mathematical principles and their economic interpretation, with technology serving to facilitate application and exploration (Saha et al., 2020).

Conclusion

The attitudes of economics students towards mathematics are a critical determinant of their academic success and professional opportunities. This comprehensive literature review demonstrates that these attitudes are complex, multi-faceted constructs shaped by a dynamic interplay among perceived relevance, psychological factors such as anxiety and self-efficacy, and the quality of pedagogical approaches. A negative attitude, often rooted in a failure to see the practical application of mathematics, can lead to a cycle of avoidance and underachievement, ultimately limiting a student's career options in a world that increasingly values quantitative skills. Conversely, fostering a positive attitude, characterized by enjoyment and confidence, is a powerful predictor of academic success and a gateway to a wider range of professional paths.

The key finding is that a student's attitude is not merely a byproduct of their mathematical ability, but an independent variable that can significantly influence their engagement and performance. This makes addressing student attitudes a crucial, rather than optional, component of effective economics education. By understanding the theoretical underpinnings of attitude formation and the specific factors that influence economics students, educators can design and implement targeted interventions that not only improve mathematical proficiency but also cultivate a lasting positive disposition towards the quantitative aspects of economics. This holistic approach is essential for preparing the next generation of economists to tackle complex global challenges effectively.

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