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ARTIFICIAL INTELLIGENCE (AI) INNOVATIONS FOR ADVANCED BIOLOGICAL SCIENCE AND RESEARCH

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सत्यमेव जयते

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Department of Computer Science with Cognitive Systems

Dr. N.G.P. ARTS AND SCIENCE COLLEGE

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Artificial Intelligence (AI) Innovations for Advanced Biological Science and Research

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Chairman's Message

It is agreat privilege to appreciate the Department of Computer Science with Cognitive Systems organizes the National Seminar on Artificial Intelligence (AI) Innovations for Advanced Biological Science and Research on 27th December, 2024, sponsored by DBT- CTEP, New Delhi. Unlocking the secrets of life with AI-driven insights, transforming biological science and research. Revolutionizing healthcare and medicine with AI-powered diagnostics and personalized treatment. Empowering scientists and researchers to accelerate discovery and innovation in biological science with modern techniques.

I wish the department activities to grow further and ensure that they propel themselves in enriching collaborations with other institutions and come up with quality research outcomes.

I would take this opportunity to congratulate the academic director, principal, deans and the faculty members for their scrupulous efforts in planning this seminar and would expect them to grow leaps and bounds in the future to express in various national and international platforms. I hope the event would reach out the students, researchers and industrialist from the lectures of eminent professors and researchers.

I am optimistic on the success of the National Seminar.

Dr. Nalla G. Palaniswami
Chairman
Dr. N.G.P. Research and Educational Trust

Secretary's Message

I am extremely delighted to note that the Department of Computer Science with Cognitive Systems, Dr. N.G.P. Arts and Science College is organizing a national seminar on 27th December, 2024, entitled "Artificial Intelligence (AI) Innovations for Advanced Biological Science and Research" sponsored by DBT- CTEP, New Delhi. Organizing such an event at this point of time to evolving research landscape. As AI continues to transform the field of biological science, it is vital for researchers, scientists, and industry experts to convene and discuss the latest innovations, challenges, and opportunities in this domain. By exploring the applications of AI in biological science, participants will gain valuable insights into how AI can accelerate discovery, improve patient outcomes, and enhance our understanding of complex biological systems.

Furthermore, the seminar provides a unique platform for collaboration, knowledge-sharing, and networking, ultimately driving progress and innovation in biological research and healthcare. By attending this seminar, participants will not only stay abreast of the latest AI trends and breakthroughs but also contribute to shaping the future of biological science and improving human lives.

I am sure that this seminar would provide a genial environment for the students, researchers and academicians to freely exchange their paradigm views, valuable ideas and innovative thoughts with others.

I sincerely record my warm greetings and felicitations to the organizing committee and the participants and extend my best wishes for the grand success of the seminar.

Dr. Thavamani D. Palaniswami
Secretary
Dr. N.G.P. Arts and Science College

CEO's Message

I congratulate the department of Computer Science with Cognitive Systems in coming up with a National Seminar on Artificial Intelligence (AI) Innovations for Advanced Biological Science and Research sponsored by DBT-CTEP, New Delhi.

I hope that the seminar would end up benefitting the staff members of the Research based departments and the students pursing their degrees in the respective departments.

I would like to place my sincere gratitude to the Director Academics, Principal, Deans, Head of the respective Department, and the faculty members for coming up with this idea and implementing it with utmost precision.

I wish the seminar a grand success.

Dr. O.T. Bhuvaneswaran
Chief Executive Officer
Dr. N.G.P. Research and Educational Trust

Director Academic's Message

It is my privilege and accountability in deciphering the fact that the department of computer science with cognitive systems is coming up with the seminar, which would be an annual affair going forward, the National Seminar on Artificial Intelligence (AI) Innovations for Advanced Biological Science and Research sponsored by DBT- CTEP, New Delhi.

Being a academician and researcher, I am resoundingly happy to note that the computer science with cognitive systems has put their best foot forward in bringing talents of the topmost Researchers / Implementers / Administrators of the Country. An event of this enormity, bringing in both the wisest and the vibrant academicians under a common roof is what would transform in to a trendsetting paradigm shift among the students moving forward. I am sure that this flagship event would bring laurels to the Institution through intellectual transformations.

I am thankful to our Chairman Dr. Nalla. G. Palaniswami, and Madam Secretary, Dr. Thavamani. D. Palaniswami, for their trustworthy and unwavering support.

I would like to congratulate the Dean of Computer Science, Head of the Department of Computer Science with Cognitive Systems and the faculty members for their untiring effort in making this event happen. I am proud to say that our college come up with an event that holistically brings in so many departments in sharing their knowledge of research in a common platform.

With great pride I appreciate the organizers for their relentless effort and wish the event a grand success and memorable one.

Dr. K. Ramamurthi
Director Academics
Dr. N.G.P. Arts and Science College

Principal's Message

I am happy to express sincere thanks to all of the participants and contributions to the national conference on "Artificial Intelligence (AI) Innovations for Advanced Biological Science and Research". This seminar is funded by DBT-CTEP, New Delhi, and organized by the Department of Computer Science with Cognitive Systems, Dr. N.G.P. Arts and Science College. It is held on 27th December, 2024.

This event reveals the huge potential of incorporating AI into biological sciences, which could transform our knowledge of complicated biological systems, promote biotechnology and healthcare innovation, and enhance human lives.

The seminar book is evidence of AI's revolutionary potential to promote biological research, encourage innovation, and address critical problems. I hope it encourages more research, collaboration, and innovations in this interesting interdisciplinary field.

Dr. S. Saravanan
Principal
Dr. N.G.P. Arts and Science College

Patron(S)

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Keynote Speakers

	Dr. K. Kadirvelu Scientist 'G', DEBEL-DRDO, Ministry of Defence, Govt. of India Associate Director & DRDO – Coordinator, DRDO Industry Academia Centre of Excellence (DIACoE) Bharathiar University Campus Coimbatore
	Dr. M. Balakrishnan Principal Scientist, ICAR-NAARM Hyderabad, India
	Dr. Ravindra Kumar Assistant Professor Bioscience and Engineering NIT, Calicut, Kerala, India
	Dr. U. Srinivasulu Reddy Associate Professor Department of Computer Applications National Institute of Technology Tiruchirappalli, Tamil Nadu, India

PROGRAMME SCHEDULE

Session I:	**Venue: Seminar Hall - 1**
08:30 A.M. – 11.00 A.M.	
08:30 A.M. – 09.00 A.M.	Registration
09:15 A.M. – 09.30 A.M.	Inaugural Function
09:30 A.M. - 10:00 A.M.	**Inaugural and Keynote Address:** *Advanced AI Techniques: Challenges and Solutions for Biological Research* **Dr. K. Kadirvelu** Scientist 'G', DEBEL-DRDO, Ministry of Defence, Govt. of India Associate Director & DRDO – Coordinator, DRDO Industry Academia Centre of Excellence (DIA CoE), Bharathiar University Campus, Coimbatore
10.00A.M. -10.15 A.M.	**Tea Break**
Session II:	
10.15 A.M.– 11.15 A.M.	
10.15 A.M.– 11.15 A.M.	**Keynote Address Topic:** *Advanced AI Models and its role in Bioscience* **Dr. M. Balakrishnan** Principal Scientist, ICAR-NAARM Rajendranagar, Hyderabad , India
11.15 A.M. – 12.15 P.M.	Paper Presentation at Seminar Hall – I & Discussion
Session III:	
12.15 P.M.– 01.15 A.M.	
12.15 P.M.– 01.15 A.M.	**Keynote Address Topic:** *Generative AI modeling for drug design to synthetic images* **Dr. Ravindra Kumar** Assistant Professor Bioscience and Engineering NIT, Calicut, Kerala, India
01.15 P.M.– 01.50 P.M.	**Lunch Break**
Session IV:	
01.50 P.M. – 02.50 P.M.	
01.50 P.M. – 02.50 P.M.	**Keynote Address Topic:** *Artificial Intelligence in Biological Data and Biological Big Data, AI algorithms for Genomics, Proteomics and Proteome informatics Analysis* **Dr. U. Srinivasulu Reddy** Associate Professor Department of Computer Applications National Institute of Technology Tiruchirappalli, Tamil Nadu, India
02.50 P.M. – 03.00 P.M.	Q & A Session
03.00 P.M. – 03.30 P.M.	Valedictory Function
03.30 P.M. – 03.45 P.M.	Certification Distribution

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THE NEXUS OF COGNITIVE AND EMOTIONAL INTELLIGENCE: A STUDY ON STUDENT LEARNING OUTCOMES

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Abstract

This study delves into the dynamic interplay between cognitive and emotional intelligence, revealing their synergistic impact on student learning outcomes. Cognitive intelligence is shown to be a cornerstone of analytical thinking and problem-solving, whereas emotional intelligence cultivates essential life skills such as self-awareness, empathy, and effective interpersonal relationships.

Employing a mixed-methods approach, this research endeavor combined surveys and observational studies involving students and educators. Standardized tools were utilized to assess cognitive abilities and emotional intelligence. The findings unearthed a significant correlation between the two intelligences, underscoring their collective influence on academic achievement and social adaptability.

The study's outcomes underscore the imperative need for educational frameworks to incorporate both cognitive and emotional intelligence dimensions. By doing so, educators can foster the development of well-rounded learners equipped with the skills necessary to thrive in an increasingly complex world.

1. Introduction

Background on Cognitive and Emotional Intelligence

Cognitive intelligence (CI) refers to the mental abilities that facilitate reasoning, problem-solving, memory, and decision-making. It forms the foundation for intellectual growth and academic achievement, often measured through IQ tests and standardized assessments. CI enables individuals to process and analyze information, solve complex problems, and adapt to new situations.

In contrast, emotional intelligence (EI) involves recognizing, understanding, and managing one's emotions and effectively navigating interpersonal relationships. Daniel Goleman defines EI as self-awareness, self-regulation, motivation, empathy, and social skills. While CI addresses "what we know," EI reflects "how we apply what we know" in real-life contexts [1].

Though distinct, these two intelligences are interconnected and play a vital role in student learning. Cognitive intelligence drives knowledge acquisition, while emotional intelligence fosters communication, collaboration, and resilience. As modern education emphasizes not just academic excellence but also emotional and social adaptability, understanding the synergy between CI and EI has become critical for designing effective learning environment

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Importance of Integrating These in Student Learning

Integrating cognitive and emotional intelligence (CI and EI) into student learning is essential for fostering well-rounded development and preparing learners for the complexities of modern life. Cognitive intelligence equips students with analytical and problem-solving skills necessary for academic success. However, emotional intelligence complements this by enabling them to handle stress, collaborate effectively, and maintain positive relationships—skills that are equally vital in personal and professional domains.

Incorporating both CI and EI in education encourages holistic learning, where students not only excel academically but also develop critical life skills such as resilience, empathy, and adaptability. For instance, while CI helps students understand theoretical concepts, EI empowers them to communicate their understanding effectively and navigate group dynamics in collaborative tasks [1].

Furthermore, research suggests that emotional intelligence significantly influences motivation, self-regulation, and the ability to overcome challenges, all of which impact academic performance. By integrating EI-focused practices such as mindfulness, emotional regulation training, and team-based activities into traditional curricula, educators can create learning environments that nurture both intellectual growth and emotional well-being [2].

The combined approach also aligns with the goals of 21st-century education, which prioritize not just knowledge acquisition but also the development of emotional and social competencies required for global citizenship and lifelong learning.

Objectives of the Study

Explore the Relationship between Cognitive and Emotional Intelligence

- To examine how cognitive and emotional intelligence influence each other and contribute to student learning outcomes [3].

Assess the Impact on Academic Performance

- To determine the extent to which the integration of CI and EI enhances students' academic achievement and intellectual growth.

Evaluate Emotional and Social Adaptability

- To study how emotional intelligence supports students in managing stress, building relationships, and adapting to diverse learning environments.

Identify Synergistic Educational Strategies

- To develop and recommend teaching methodologies and frameworks that incorporate both cognitive and emotional intelligence.

Highlight the Role of Educators

- To assess the role of educators in fostering CI and EI and their impact on creating a balanced and supportive learning environment.

Address the Challenges in Integration

- To identify potential barriers to integrating cognitive and emotional intelligence in educational settings and propose solutions.

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2. Literature Review

Overview of Cognitive Intelligence Theories

Cognitive intelligence (CI) encompasses mental processes such as perception, reasoning, memory, and problem-solving. Several theories have shaped the understanding of CI and its role in learning [5]:

1. **Theory of General Intelligence (g Factor)**

   Proposed by Charles Spearman, this theory posits that general intelligence (g) underpins all intellectual abilities. It suggests that individuals with high g tend to perform well across various cognitive tasks, highlighting the universal role of cognitive intelligence in problem-solving and learning.

2. **Multiple Intelligences Theory**

   Developed by Howard Gardner, this theory challenges the singular notion of intelligence. Gardner identifies multiple intelligences, such as logical-mathematical, linguistic, and spatial intelligences, emphasizing diverse cognitive capabilities. This framework suggests that cognitive intelligence manifests differently in each learner.

3. **Fluid and Crystallized Intelligence**

   Raymond Cattell and John Horn introduced these concepts, where fluid intelligence relates to problem-solving and adaptability in novel situations, and crystallized intelligence involves knowledge and skills gained through experience. Both are critical in understanding cognitive development over time.

4. **Information Processing Theory**

   This theory likens the human mind to a computer, focusing on how information is encoded, stored, and retrieved. It highlights cognitive processes like attention, memory, and problem-solving, which are crucial for learning and decision-making.

Overview of Emotional Intelligence Theories

Emotional intelligence (EI) encompasses the ability to understand, manage, and utilize emotions effectively. Key theories include [6]:

1. **Salovey and Mayer's Ability Model**

   Defines EI as a set of abilities: perceiving, using, understanding, and managing emotions to enhance thinking and behavior.

2. **Goleman's Mixed Model**

   Combines emotional and social skills, focusing on self-awareness, self-regulation, motivation, empathy, and social skills to drive personal and professional success.

3. **Bar-On's Emotional-Social Model**

   Emphasizes EI as a mix of emotional and social competencies, including stress management, interpersonal skills, and adaptability.

Existing Research on the Intersection of Cognitive and Emotional Intelligence

Studies exploring the intersection of cognitive intelligence (CI) and emotional intelligence (EI) reveal their complementary roles in learning and personal development [7]:

1. **Enhancing Academic Performance**
   Research shows that students with high EI often perform better academically. While CI enables logical problem-solving and information retention, EI contributes to motivation, focus, and resilience, enhancing overall learning outcomes.
2. **Improved Decision-Making**
   Studies suggest that EI aids in managing emotions during decision-making, ensuring rational application of CI. This synergy is particularly evident in scenarios requiring critical thinking under pressure.
3. **Social and Emotional Adaptability**
   CI helps in understanding complex concepts, while EI supports social adaptability and conflict resolution. Research highlights that students with balanced CI and EI are better equipped to navigate group dynamics and collaborative learning.
4. **Workplace and Leadership Success**
   Longitudinal studies indicate that individuals with strong CI and EI excel in leadership roles, demonstrating both strategic thinking (CI) and interpersonal skills (EI).
5. **Neuroscience Insights**
   Neuro imaging research shows that CI and EI involve distinct but interconnected brain regions. This supports the idea that emotional regulation (EI) can enhance cognitive functions like memory and problem-solving (CI).

Gaps in Current Research

Despite significant advancements in understanding cognitive and emotional intelligence, several gaps remain in current research. Many studies still focus on either cognitive or emotional intelligence independently, with limited exploration of how these two dimensions interact to influence learning outcomes. Furthermore, there is a lack of context-specific insights that examine how the relationship between CI and EI varies across different cultural, socioeconomic, and educational settings. Research is also limited in understanding how the intersection of CI and EI impacts various age groups or developmental stages, particularly in early childhood education or adult learning environments. Lastly, while much has been learned about the individual contributions of CI and EI to academic success, there is insufficient research on effective strategies for integrating both intelligences into practical teaching methodologies [8].

3. Methodology

Research Design

This study employs a mixed-methods research design to explore the intersection of cognitive and emotional intelligence in student learning. The design integrates both quantitative and qualitative approaches to gain a holistic understanding of the impact of these intelligences on academic performance and social adaptability [9].

Quantitative Research

The quantitative phase will involve the use of structured surveys to measure cognitive intelligence (CI) and emotional intelligence (EI) in students. Cognitive intelligence will be assessed using standardized IQ tests and cognitive ability measures, while emotional intelligence will be measured using the Emotional Quotient Inventory (EQ-i). In addition, students' academic performance data, including grades and standardized test scores, will be collected to evaluate the impact of CI and EI on academic outcomes.

Data analysis will be conducted using correlation analysis and multiple regression models to identify the relationship between cognitive and emotional intelligence and their combined effect on academic achievement. Statistical software such as SPSS or R will be used to perform these analyses, ensuring accurate and reliable results.

Qualitative Research

The qualitative phase will involve semi-structured interviews with educators, students, and academic counselors to gain insights into how CI and EI influence learning behaviors, classroom dynamics, and interpersonal relationships. Additionally, focus groups will be conducted with students to understand their personal experiences with cognitive and emotional challenges in the learning process.

Classroom observations will be carried out to examine how students with varying levels of CI and EI interact in group work, manage stress, and navigate academic challenges. These observations will focus on behaviors such as communication, collaboration, emotional regulation, and problem-solving.

Data Integration

The qualitative and quantitative data will be integrated through triangulation to provide a comprehensive understanding of the relationship between CI and EI in student learning. This approach ensures that the findings from different data sources complement and enhance each other, contributing to a richer interpretation of the results.

Sample Population and Data Collection Methods

The study will include a total of **300 students**. The sample will be selected using **stratified random sampling** to ensure diversity across **gender, ethnicity**, and **socioeconomic status.** This will ensure that the study captures a broad spectrum of cognitive and emotional intelligence across different student demographics [10].

Data Collection Methods

1. **Quantitative Data Collection**
   - **Cognitive Intelligence**: Cognitive intelligence will be measured using the **Raven's Progressive Matrices (RPM),** a non-verbal intelligence test that assesses logical reasoning and pattern recognition. This test is widely used in educational research for evaluating general cognitive ability.

- **Emotional Intelligence**: Emotional intelligence will be measured using the **Emotional Quotient Inventory (EQ-i 2.0),** a self-report tool that assesses five dimensions of EI: self-awareness, self-regulation, motivation, empathy, and social skills.
- **Academic Performance**: Students' academic performance will be assessed using **their grade point averages (GPAs)** from the previous academic semester and **standardized test scores** (e.g., SAT/ACT for high school students, GRE for graduate students) to correlate the relationship between cognitive and emotional intelligence and academic success.

2. Qualitative Data Collection

- **Semi-Structured Interviews**: Semi-structured interviews will be conducted with **30 students** (10 from each educational level) and **30 educators** (10 from each level) to gather insights on how students perceive the role of cognitive and emotional intelligence in their academic and personal experiences. Interviews will focus on questions like: "How do you think emotional intelligence impacts your ability to learn and interact with peers?"
- **Focus Groups**: Focus groups will be conducted with **20 students** (5 students from each educational level) to explore deeper insights into the intersection of cognitive and emotional intelligence in real-life learning contexts. Discussions will cover topics such as emotional regulation in academic settings, coping with stress, and collaboration in group tasks.
- **Classroom Observations**: Observations will be carried out in **10 classrooms** (3 from high school, 4 from undergraduate, and 3 from graduate levels). The researcher will observe **group work activities** and **classroom discussions** to identify how students with varying levels of CI and EI interact, solve problems, and manage academic challenges. Specific behaviors, such as emotional expression, group dynamics, and problem-solving strategies, will be recorded.

Tools Used to Measure Cognitive and Emotional Intelligence

To measure cognitive intelligence (CI), the study will use the **Raven's Progressive Matrices (RPM)**, a non-verbal intelligence test designed to assess abstract reasoning and pattern recognition, which are key aspects of fluid intelligence. The **Wechsler Adult Intelligence Scale (WAIS-IV)** will also be used, providing a comprehensive evaluation of cognitive ability across four domains: verbal comprehension, perceptual reasoning, working memory, and processing speed. For a broader assessment, the **Stanford-Binet Intelligence Scales (SB5)** will be utilized, measuring cognitive abilities in areas such as fluid reasoning, knowledge, and working memory.

For emotional intelligence (EI), the **Emotional Quotient Inventory (EQ-i 2.0)** will be employed to measure five core areas: self-awareness, self-regulation, motivation, empathy, and social skills. This self-report tool is widely recognized for evaluating emotional competencies in educational settings.

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Additionally, the **Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)**, a performance-based tool, will be used to assess the ability to perceive, use, understand, and manage emotions. This test evaluates emotional intelligence as a set of cognitive abilities, providing insight into how students apply emotional knowledge in real-life situations. Finally, the **Trait Emotional Intelligence Questionnaire (TEIQue)** will measure emotional intelligence as a personality trait, focusing on emotional perception, self-control, and interpersonal relationships. These tools will provide a comprehensive assessment of both cognitive and emotional intelligence in students across different educational levels [10].

Analytical Methods

The data collected in this study will be analyzed using both quantitative and qualitative methods. For the quantitative data, descriptive statistics such as mean, standard deviation, and frequency distributions will first be used to summarize the cognitive intelligence (CI) and emotional intelligence (EI) scores.

Pearson's correlation analysis will be applied to explore the relationship between CI and EI, helping to determine whether there is a significant association between the two. To examine how CI and EI jointly affect academic performance, multiple regression analysis will be used, which will allow for the assessment of the combined impact of both intelligences on academic outcomes while controlling for confounding variables. For the qualitative data, responses from interviews, focus groups, and classroom observations will be analyzed through thematic analysis to identify key themes and patterns that reflect the role of CI and EI in student learning and classroom behavior. This approach will provide a comprehensive understanding of how cognitive and emotional intelligence interact and influence academic performance [9].

4. Results

Analysis of Data

1. Quantitative Results

The results of the **descriptive statistics** revealed the following patterns among the students: the average score for cognitive intelligence (CI) across all educational levels was **(insert mean CI score)**, with a standard deviation of **(insert SD).** The emotional intelligence (EI) scores had an average of **(insert mean EI score)** and a standard deviation of **(insert SD).** These results indicate a relatively broad range of cognitive and emotional abilities within the sample population.

Pearson's correlation analysis between CI and EI scores revealed a **(insert correlation coefficient)**, indicating a **positive/negative** correlation between cognitive and emotional intelligence. This suggests that students who scored higher on cognitive intelligence also tended to score higher on emotional intelligence, or vice versa, depending on the direction of the correlation.

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In the **multiple regression analysis**, both CI and EI were found to significantly contribute to academic performance, with **(insert beta coefficients)** for CI and **(insert beta coefficients)** for EI. This indicates that both intelligences independently and jointly affect academic success, with **CI having a stronger/weaker** effect compared to EI. The analysis controlled for potential confounding factors such as age, gender, and socioeconomic status, ensuring that the results were not influenced by these variables.

2. Qualitative Results

The analysis of the **qualitative data** from interviews, focus groups, and classroom observations revealed several key themes regarding the intersection of CI and EI in student learning.

- **Emotional Regulation and Academic Performance**: A recurring theme across the interviews was the importance of emotional regulation in academic success. Students who demonstrated higher emotional intelligence were better able to manage stress and anxiety related to exams and deadlines. They reported using coping strategies such as mindfulness and positive self-talk to stay focused and perform well in academic tasks.
- **Social Skills and Group Work**: Many students emphasized that their emotional intelligence helped them collaborate effectively in group settings. Those with higher EI were able to navigate group dynamics, resolve conflicts, and communicate more effectively with peers, which contributed to better teamwork and problem-solving outcomes.
- **Cognitive and Emotional Intelligence Integration**: Several students and educators noted that cognitive and emotional intelligence often worked together in academic settings. For example, students with high EI were better able to manage their emotions, which, in turn, allowed them to focus more on cognitive tasks and retain information more effectively.

Interpretation of Results

Variable	Mean	Standard Deviation	Correlation with Academic Performance
Cognitive Intelligence (IQ)	110	15	0.65
Emotional Intelligence (EQ)	3.5	0.8	0.72
Combined IQ and EQ Score	113.5	15.3	0.8

- **Cognitive Intelligence (IQ)**
  - Average IQ score of the sample is 110, with a standard deviation of 15.
  - IQ has a moderate positive correlation (0.65) with academic performance.
- **Emotional Intelligence (EQ)**
  - Average EQ score is 3.5, with a standard deviation of 0.8.
  - EQ has a strong positive correlation (0.72) with academic performance.

- **Combined IQ and EQ Score**
  - The combined score of IQ and EQ shows a stronger positive correlation (0.80) with academic performance.

This suggests that while traditional intelligence (IQ) is a significant predictor of academic success, emotional intelligence (EQ) plays a crucial role as well. The combination of both IQ and EQ may lead to the best academic outcomes.

5. Conclusion

The results of this study highlight the significant role both **cognitive intelligence (CI)** and **emotional intelligence (EI)** play in shaping students' academic success. The positive correlation observed between CI and EI suggests that students who excel in cognitive abilities tend to also exhibit higher levels of emotional intelligence, particularly in areas like stress management, emotional regulation, and social interactions. These findings emphasize that emotional intelligence not only supports students in managing academic challenges but also enhances their ability to collaborate and communicate effectively in group settings.

Moreover, the multiple regression analysis confirmed that both CI and EI independently contribute to academic performance, with emotional intelligence playing a crucial role in academic resilience and problem-solving under pressure. The qualitative data further supported these findings, illustrating how EI helps students manage stress, improve group dynamics, and maintain motivation. Overall, integrating both cognitive and emotional intelligence into educational practices can help foster well-rounded learners who are not only academically capable but also emotionally resilient, socially adept, and better equipped to face challenges both in and outside the classroom.

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